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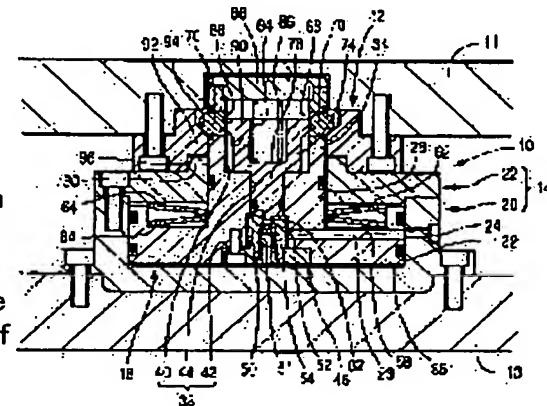
## (54) TIGHTENING APPARATUS

**(57)Abstract:**

**PROBLEM TO BE SOLVED:** To provide a tightening apparatus to eliminate the tightened condition of two members by clamps by releasing one clamp of one tightening body for the other tightening body with a pressurized oil of the quantity as small as possible.

**SOLUTION:** A protruded portion from the first

tightening body 10 of a movable member 70 is engaged with the second tightening body 12 by moving a first piston member 18 to one side in the axial direction with the second tightening body 12 fitted to the first tightening body 10 provided with the first and second piston members 18 and 16 which are moved to one side in the axial direction by the respective pressing force of first and second pressing means 86 and 84 and moved to the other side in the axial direction by the hydraulic pressure, and the movable member 70 to be projectingly moved as the first piston member 18 is moved to one side in the axial direction, and the second tightening body 12 is clamped between the protruded portion and a contact portion of the second tightening body 12 with the first tightening body 10 so that the first and second tightening bodies 10 and 12 tighten the two fixed members 13 and 11.



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## CLAIMS

## [Claim(s)]

[Claim 1] The first conclusion object attached in location immobilization to one member of the two members which should be concluded, this -- it attaches in location immobilization to the member of another side of the two members -- having -- this, while having the second conclusion object made to fit in to the first conclusion object The first and second piston members which are made to move to shaft-orientations one side by each first and second energization force of an energization means, and are made to move to the shaft-orientations other side to the conclusion object of this first by oil pressure. By migration to the shaft-orientations one side of the piston member of this first, it moves in the right-angled direction to these shaft orientations. While at least one migration member made to project from the conclusion object of this first is prepared, said second conclusion object is received. Under the projection condition, the engagement section which can be engaged is prepared in the migration member of the conclusion object of this first, and it is constituted, and the conclusion object of them first, and the second conclusion object under the condition combined so that it might fit in in said shaft orientations By making the piston member of this first move to shaft-orientations one side according to the energization force of said first energization means, and making said migration member project from the conclusion object of this first while making this migration member engage with the engagement section of said second conclusion object -- this -- by making the second piston member move to shaft-orientations one side according to the energization force of said second energization means It clamps between said fitting parts to the second conclusion object. this -- this migration member made to engage with the engagement section of the second conclusion object -- this -- the second piston member -- pressing -- this -- the second conclusion object -- this migration member -- this -- the first conclusion object -- this -- The fastener characterized by concluding mutually said two members which should be concluded at least in the condition which cannot be displaced relatively to said shaft orientations.

[Claim 2] The cam mechanism which changes motion of the shaft orientations of the piston member of this first into motion of a right-angled direction to these shaft orientations, and is transmitted to this migration member between said first piston member and said migration members is constituted. According to this cam mechanism The fastener according to claim 1 with which this migration member is made to move in the right-angled direction to these shaft orientations, and is made to project from said first conclusion object with the migration to said shaft-orientations one side of the piston member of this first.

[Claim 3] The fastener according to claim 1 or 2 with which said migration member consists of ball members.

[Claim 4] Give the first oil pressure room which makes said oil pressure exerted on the shank of said second piston member to said first piston member produce by installation of pressure oil. The cylinder part which consists of an insertion hole which extends in shaft orientations is prepared. In the cylinder part of this second piston member The piston member of this first is made to move to said shaft-orientations other side by the oil pressure you are made to produce in the oil pressure interior of a room of this first. And while being arranged so that it may be made to move to said shaft-orientations one side by the energization force of said first energization means Said first conclusion object has further the cylinder part material which

gives the second oil pressure room which makes said oil pressure done to said second piston member produce by installation of pressure oil, and is constituted. It is made to move to said shaft-orientations other side by the oil pressure you are made to produce in the second oil pressure interior of a room. the inside of this cylinder part material -- this -- the second piston member -- this -- And a fastener given in any of claim 1 arranged so that it may be made to move to said shaft-orientations one side by the energization force of said second energization means thru/or claim 3 they are.

[Claim 5] While the breakthrough which penetrates this side attachment wall on the side attachment wall of the part made to project by the method of outside, and is prolonged in a right-angled direction on it to said shaft orientations from said cylinder part material of said cylinder part in said second piston member is formed In this breakthrough, said migration member is arranged movable in the direction in which this breakthrough is prolonged. By migration to said shaft-orientations one side of said first piston member within this cylinder part The fastener according to claim 4 made to project from said first conclusion object by making this migration member move in the direction in which it is prolonged in the inside of this breakthrough, and making it project from opening of this breakthrough.

[Claim 6] While establishing the inlet which introduces said pressure oil from the outside in said first oil pressure room The free passage hole which opens them for free passage is prepared between the oil pressure room of this first, and said second oil pressure room. from this inlet -- this -- the pressure oil introduced into the first oil pressure interior of a room -- this free passage hole -- leading -- this, while it constitutes so that it may be made to flow toward the second oil pressure room this free passage hole -- liquid -- the valve element which may be blockaded densely -- this -- from a second oil pressure room side -- this -- the condition that you were made to energize toward a first oil pressure room side -- arranging -- this -- until the first oil pressure interior of a room is full of said pressure oil this valve element -- this free passage hole -- liquid, when this pressure oil is made to introduce into the first oil pressure interior of a room which it blockaded densely and was made full of this pressure oil further the energization force in which you are made to act this valve element by it -- resisting -- this -- from a first oil pressure room side -- this -- the fastener according to claim 4 or 5 constituted so that it might be made to move toward a second oil pressure room side and the lock out by this valve element of this free passage hole could be canceled.

[Claim 7] While preparing the exhaust port which discharges outside said pressure oil introduced into the interior in said first oil pressure room Under the condition which prepared the projected part which can be inserted in in said free passage hole at the head of said shaft-orientations one side in said first piston member, and discharged all of the pressure oil of this first oil pressure interior of a room outside from this exhaust port By making the piston member of this first move to this shaft-orientations one side according to the energization force of said first energization means, and making said projected part of the piston member of this first insert in in said free passage hole By pressing said valve element in this projected part, resisting said energization force in which you are made to act by it, making it move toward said second oil pressure room side from the oil pressure room side of this first, and making the lock out by this valve element of this free passage hole cancel The fastener according to claim 6 constituted so that the oil pressure interior of a room of this first might be made to flow through this account free passage hole and said pressure oil of this second oil pressure interior of a room might be made to discharge outside from the oil pressure interior of a room of this first through said exhaust port further.

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## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the fastener which can conclude two predetermined members promptly and easily, and relates to the fastener which may be used suitable to conclude mutually the base element especially attached in machine tool tables, such as a machining center, and the fixture plate with which a predetermined fixture is fixed.

[0002]

[Background of the Invention] Conventionally, as a fastener for concluding two members, there is a thing of various structures, and according to a configuration, an application, etc. of a member which should be concluded, it is used out of them, being chosen suitably. And for example, also in machine tools, such as a machining center, various fasteners are used.

[0003] Namely, although various kinds of fixtures, such as a clamp and a vice, are generally used in order to hold the work piece which should be processed if it is in machine tools, such as a machining center Since those fixtures make the housekeeping \*\*\*\* perform easily and promptly In many cases, it is fixed to the fixture plate and various kinds of fixtures are attached in a base element by making this fixture plate conclude to a base element. And the predetermined fastener is used as a thing which makes these fixture plate and a base element conclude mutually.

[0004] By the way, the fastener which has as one the \*\*\*\* structure shown in drawing 5 and drawing 6 although used as such a fastener is known conventionally. This fastener has the first conclusion object 102 and the second conclusion object 104 which were attached in location immobilization, respectively to the base element 13 and the fixture plate 11 as two members which should be concluded. By moreover, migration to the shaft-orientations one side of the piston 108 which is made to move to the first conclusion object 102 according to the spring force of a belleville spring 106 by shaft-orientations one side, and is made to move to the shaft-orientations other side by oil pressure, and this piston 108 It is pressed by the method of outside in respect of [ 110 ] press of the taper side configuration formed in the peripheral face of this piston 108, moves in the right-angled direction to these shaft orientations, and two or more steel balls 112 made to project by the method of outside are arranged. On the other hand, the engagement section 114 which can be engaged is formed [ the second conclusion object 104 ] in the bottom of the projection condition to the method of the outside at two or more steel balls 112 in the first conclusion object 102.

[0005] If it is in this fastener, make the first conclusion object 102 attach the second conclusion object 104 outside, and them and under the condition combined so that it might contact mutually in shaft orientations By making a piston 108 move to shaft-orientations one side according to the spring force of a belleville spring 106, and making two or more steel balls 112 project in the method of outside While making the steel ball 112 of these plurality engage with the engagement section 114 of the second conclusion object 104 Have the thrust based on the spring force of a belleville spring 106, and two or more steel balls 112 are pressed in the press side 110 of a piston 108. This engagement section 114 is clamped between two or more steel balls 112 and said contact part to the second conclusion object 104 of the first conclusion object 102. With, said fixture plate 11 and base element 13 which should be concluded can be mutually concluded now in the condition which cannot be displaced relatively

to shaft orientations. moreover, in case the conclusion condition of the fixture plate 11 and the base element 13 by such fastener is canceled The predetermined pressure oil 118 is made to introduce in the oil pressure room 116 formed in the interior of the first conclusion object 102, as shown in drawing 6 . By resisting the spring force of a belleville spring 106, making a piston 108 move to the shaft-orientations other side, and carrying out level-luffing-motion migration of two or more steel balls 112 with the oil pressure produced in that case The engagement to the engagement section 114 of the second conclusion object 104 of the steel ball 112 of these plurality is made to cancel.

[0006] Moreover, this fastener and the fastener indicated by JP,10-138068,A as equipment which has the same conclusion structure as abbreviation are also known. This fastener inserts the second conclusion object called a nipple into the feed hole established in the first conclusion object called a clamping cylinder. Under the condition which combined the conclusion object of them first, and the second conclusion object so that it might contact mutually in shaft orientations While pressing two or more locking pistons equivalent to two or more steel balls in respect of press of the taper side configuration of the piston made to move to shaft-orientations one side by the spring force, making them project in said feed hole and making them engage with the second conclusion object By having the thrust based on this spring force, and clamping the second conclusion object between two or more locking pistons and the contact part to the second conclusion object of the first conclusion object Two members in which the first and second each of a conclusion object was attached are concluded mutually. In addition, even if it is in this fastener, in case the conclusion condition of two members is canceled, the engagement to the second conclusion object of the locking piston of these plurality is made to cancel by resisting the spring force, making a piston move to the shaft-orientations other side with oil pressure, and carrying out level-luffing-motion migration of two or more locking pistons.

[0007] If such a conventional fastener is used, the first conclusion object 102 and the second conclusion object 104 which were attached in location immobilization at two members which should be concluded under the condition combined so that it might contact mutually in shaft orientations Only by performing actuation which only discharges the pressure oil 118 introduced in the oil pressure room 116 inside [ conclusion object 102 ] the first out of this oil pressure room 116, and actuation which introduces this pressure oil 118 in the oil pressure room 116 Conclusion and its discharge of two members which should be concluded can be performed very easily and promptly.

[0008] However, if it is in the conventional fastener like \*\*\*\* All in order to make two or more steel balls 112 or projection migration of a locking piston ensure It sets in the oil pressure room 116, stopping small the pressure of the pressure oil 118 which the migration stroke of a piston 108 is set up greatly enough, and is introduced in the oil pressure room 116 as much as possible. To the piston 108, the area of the pressure acceptance side of a piston 108 also had the fault that the amount of the pressure oil 118 introduced in the oil pressure room 116 will increase unescapable from the place greatly set up in comparison so that a bigger pressure could be done.

[0009] So, when concluding the members which have a large area, using such a conventional fastener two or more, the large-sized hydraulic pump in which the regurgitation is possible was needed for the large quantity in pressure oil, and the problem the workability of the conclusion activity of those members not only gets worse remarkably, but that the activity cost soared by it was caused.

[0010]

[Problem(s) to be Solved] The place which this invention makes the above-mentioned \*\*\*\*\* situation a background, succeeds in it in here, and is made into the solution technical problem Having two conclusion objects attached in location immobilization to each of two members which should be concluded, and making one thing of these two conclusion objects engage with the thing of another side By having the clamp force based on the predetermined energization force, and clamping the conclusion object of this another side with one conclusion object While concluding said two members mutually, with the oil pressure which resists this energization force and is demonstrated The clamp of the conclusion object of this another side

with one [this] conclusion object is made to cancel, and it is in offering the new structure which might make it have made it the amount of the pressure oil which makes this oil pressure produce decrease advantageously in the fastener of which the conclusion condition of these two members was canceled.

[0011]

[Means for Solution] And the first conclusion object attached in location immobilization to one member of the two members which should be concluded in order to solve this technical problem, if it is in this invention, this -- it attaches in location immobilization to the member of another side of the two members -- having -- this, while having the second conclusion object made to fit in to the first conclusion object The first and second piston members which are made to move to shaft-orientations one side by each first and second energization force of an energization means, and are made to move to the shaft-orientations other side to the conclusion object of this first by oil pressure, By migration to the shaft-orientations one side of the piston member of this first, it moves in the right-angled direction to these shaft orientations. While at least one migration member made to project from the conclusion object of this first is prepared, said second conclusion object is received. Under the projection condition, the engagement section which can be engaged is prepared in the migration member of the conclusion object of this first, and it is constituted, and the conclusion object of them first, and the second conclusion object under the condition combined so that it might fit in in said shaft orientations By making the piston member of this first move to shaft-orientations one side according to the energization force of said first energization means, and making said migration member project from the conclusion object of this first while making this migration member engage with the engagement section of said second conclusion object -- this -- by making the second piston member move to shaft-orientations one side according to the energization force of said second energization means It clamps between said fitting parts to the second conclusion object. this -- this migration member made to engage with the engagement section of the second conclusion object -- this -- the second piston member -- pressing -- this -- the second conclusion object -- this migration member -- this -- the first conclusion object -- this -- Let the fastener characterized by concluding mutually said two members which should be concluded at least in the condition which cannot be displaced relatively to said shaft orientations be the summary.

[0012] If it is in the fastener according to such this invention By preparing the first and two pistons member of \*\* a second, and making the first piston member move to shaft-orientations one side by the energization force of the first energization means among these two piston members to the first conclusion object While a migration member carries out projection migration and is made to engage with the engagement section of the second conclusion object, when being cheated by migration by the energization force of the second energization means to shaft-orientations one side, the second piston member The first piston member for carrying out projection migration of the migration member from the place clamped between the migration member and the first conclusion object in which the second conclusion object carries out projection migration, The second piston member for clamping the second conclusion object can be constituted with the area of a mutually different migration stroke or a pressure acceptance side between this migration member and the first conclusion object.

[0013] So, setting up greatly enough so that a migration member can carry out projection migration of the migration stroke of the first piston member for carrying out projection migration of the migration member certainly in this fastener The area of the pressure acceptance side of the second piston member for being able to succeed in the area of the pressure acceptance side small, and clamping the second conclusion object between a migration member and the first conclusion object Succeeding in the migration stroke small is possible, setting up greatly in comparison so that bigger oil pressure may be done. By it Only one piston member is arranged and becomes the conventional fastener, i.e., the first conclusion object. So that a migration member may carry out projection migration certainly in this piston member and bigger oil pressure may be done to this one piston member this -- one piston member becomes possible [ stopping advantageously the amount of pressure oil required to resist the energization force of an energization means and move a piston member to the shaft-

orientations other side as compared with the fastener constituted with a big migration stroke and the area of a big pressure acceptance side, few ].

[0014] Therefore, if it is in the fastener according to writing \*\*\*\* this invention, the amount of the pressure oil needed for canceling the conclusion condition of two concluded members may be made to decrease very effectively as compared with the conventional fastener. And in case the members which have a large area are concluded as a result, using a fastener two or more, while the workability at the time of being able to close pressure oil if there is no need of using for a large quantity the large-sized hydraulic pump in which the regurgitation is possible, with making these members conclude may be raised advantageously, the activity cost may be held down low effectively.

[0015] In addition, according to one of the advantageous modes of a fastener according to such this invention The cam mechanism which changes motion of the shaft orientations of the piston member of this first into motion of a right-angled direction to these shaft orientations, and is transmitted to this migration member between said first piston member and said migration members is constituted. According to this cam mechanism With the migration to said shaft-orientations one side of the piston member of this first, this migration member is made to move in the right-angled direction to these shaft orientations, and it is constituted so that it may be made to project from said first conclusion object. A migration member has comparatively simple structure, may be made to move in the right-angled direction to shaft orientations, and may be made to certainly project from the first conclusion object in the fastener which has such a configuration.

[0016] moreover, another desirable voice of the fastener according to this invention -- according to one [ like ], said migration member consists of ball members, and projection migration of the migration member from the first conclusion object may be more smoothly performed by it.

[0017] Furthermore, according to one of the desirable modes of other of a fastener according to this invention Give the first oil pressure room which makes said oil pressure exerted on the shank of said second piston member to said first piston member produce by installation of pressure oil. The cylinder part which consists of an insertion hole which extends in shaft orientations is prepared. In the cylinder part of this second piston member The piston member of this first is made to move to said shaft-orientations other side by the oil pressure you are made to produce in the oil pressure interior of a room of this first. And while being arranged so that it may be made to move to said shaft-orientations one side by the energization force of said first energization means Said first conclusion object has further the cylinder part material which gives the second oil pressure room which makes said oil pressure done to said second piston member produce by installation of pressure oil, and is constituted. the inside of this cylinder part material -- this -- the second piston member -- this -- it will be arranged so that it may be made to move to said shaft-orientations other side by the oil pressure you are made to produce in the second oil pressure interior of a room and may be made to move to said shaft-orientations one side by the energization force of said second energization means.

[0018] If it is in the fastener which has such a configuration The second piston member in the condition of having been arranged in predetermined cylinder part material the first piston member -- this, since it will be arranged in same axle in the cylinder part prepared in the shank of the second piston member As compared with the case where the piston member of them first and the second piston member are estranged and arranged in a longitudinal direction or the vertical direction, the magnitude of the whole equipment is miniaturized and it may be constituted by the compact in comparison.

[0019] moreover, when said first piston member and said second piston member are arranged as mentioned above advantageous -- this, while the breakthrough which penetrates this side attachment wall on the side attachment wall of the part made to project by the method of outside, and is prolonged in a right-angled direction on it to said shaft orientations from said cylinder part material of said cylinder part in the second piston member is formed In this breakthrough, said migration member is arranged movable in the direction in which this breakthrough is prolonged. By migration to said shaft-orientations one side of said first piston member within this cylinder part By making this migration member move in the direction in

which it is prolonged in the inside of this breakthrough, and making it project from opening of this breakthrough, it is constituted so that it may be made to project from said first conclusion object.

[0020] In a cylinder part [ according to the writing \*\*\*\* configuration / in / in a migration member / the second piston member ] It is arranged in the breakthrough prepared in the side attachment wall, and this breakthrough is led. From the place which will be constituted so that it may project/level-luffing-motion move in the right-angled direction to the shaft orientations of the first piston member It is not necessary to provide the arrangement tooth space of a migration member apart from the first and second arrangement tooth spaces of a piston member, and small [ of the whole equipment ] and miniaturization may be attained more by it at validity.

[0021] furthermore, under the arrangement condition like the above-mentioned of said first piston member and said second piston member While establishing preferably the inlet which introduces said pressure oil from the outside in said first oil pressure room The free passage hole which opens them for free passage is prepared between the oil pressure room of this first, and said second oil pressure room. from this inlet -- this -- the pressure oil introduced into the first oil pressure interior of a room -- this free passage hole -- leading -- this, while it is constituted so that it may be made to flow toward the second oil pressure room this free passage hole -- liquid -- the valve element which may be blockaded densely -- this -- from a second oil pressure room side -- this -- the condition that you were made to energize toward a first oil pressure room side -- arranging -- this -- until the first oil pressure interior of a room is full of said pressure oil this valve element -- this free passage hole -- liquid, when this pressure oil is made to introduce into the first oil pressure interior of a room which it blockaded densely and was made full of this pressure oil further the energization force in which you are made to act this valve element by it -- resisting -- this -- from a first oil pressure room side -- this -- it will be made to move toward a second oil pressure room side, and it will be constituted so that the lock out by this valve element of this free passage hole can be canceled.

[0022] Since it begins and pressure oil is made to flow into the second oil pressure interior of a room according to such a configuration after pressure oil is first introduced only into the first oil pressure interior of a room and the oil pressure interior of a room of this first is full of pressure oil, pressure oil may be made certainly full to the first and second each of an oil pressure room.

[0023] Again furthermore, under the arrangement condition like the above-mentioned of said first piston member and said second piston member While preparing desirably the exhaust port which discharges outside said pressure oil introduced into the interior in said first oil pressure room Under the condition which prepared the projected part which can be inserted in in said free passage hole at the head of said shaft-orientations one side in said first piston member, and discharged all of the pressure oil of this first oil pressure interior of a room outside from this exhaust port By making the piston member of this first move to this shaft-orientations one side according to the energization force of said first energization means, and making said projected part of the piston member of this first insert in in said free passage hole By pressing said valve element in this projected part, resisting said energization force in which you are made to act by it, making it move toward said second oil pressure room side from the oil pressure room side of this first, and making the lock out by this valve element of this free passage hole cancel It is constituted so that the oil pressure interior of a room of this first may be made to flow through this account free passage hole and said pressure oil of this second oil pressure interior of a room may be made to discharge outside from the oil pressure interior of a room of this first through said exhaust port further.

[0024] If this configuration is adopted, while the first piston member will be made to move to shaft-orientations one side by the energization force of the first energization means and a migration member will carry out projection migration from the first conclusion object It begins, after being made to engage with the engagement section of the second conclusion object. The second piston member Since it will be made to move to shaft-orientations one side by the energization force of the second energization means and the second conclusion object will be

clamped between this migration member and the first conclusion object. Before a migration member fully carries out projection migration from the first conclusion object, the clamp force over the second conclusion object What you are made to be generated between this migration member and the first conclusion object can conclude two members which may be prevented advantageously, with should be concluded that it is very good and certainly.

[0025]

[Embodiment of the Invention] Suppose that it explains to a detail, referring to a drawing about the concrete configuration of the fastener concerning this invention hereafter, in order to clarify this invention still more concretely.

[0026] First, it has the structure of following this invention in drawing 1 , and an example of the fastener used in order to conclude mutually the base element and fixture plate which are attached in the table of machine tools, such as a machining center, is roughly shown in it. So that clearly also from this drawing 1 a fastener It has the first conclusion object 10 and the second conclusion object 12, and is constituted. The first conclusion object 10 It is attached in location immobilization to the base element 13 caudad located among the fixture plate 11 by which opposite arrangement was carried out up and down, and the base element 13, and the second conclusion object 12 is attached in location immobilization to the fixture plate 11 located up.

[0027] And the first conclusion object 10 which constitutes this fastener [ in the cylinder part material 14 fixed to the base element 13, and this cylinder part material 14 ] shaft orientations -- the upper and lower sides -- the interior of the large piston 16 as second piston member arranged movable, and this large piston 16 -- setting -- shaft orientations -- the upper and lower sides -- it changes, including further the small piston 18 as first piston member arranged movable.

[0028] More specifically, the cylinder part material 14 has the barrel section 20 which presents the shape of an abbreviation one side closed-end cylindrical shape of the shallow bottom which carries out opening toward the upper part, and the head section 22 which presents a heavy-gage approximate circle plate configuration. Moreover, \*\*\*\*\* 24 to which the pressure oil 23 connected to the hydraulic pump which is not illustrated can circulate penetrates a barrel wall in the thickness direction, and while being prepared, the flange projection 26 which carries out predetermined height projection horizontally is plurality and really formed in the peripheral face of this barrel wall at the barrel section 20 of this cylinder part material 14. Furthermore, from this opening edge, as the cylindrical projection 30 which the circular feed hole 28 penetrates this center section in the head section 22, and is established in the center section at it, and has the same bore as a feed hole 28 at the opening edge of this feed hole 28 has predetermined height and begins to be prolonged up, it is set up in one.

[0029] And cover the up opening to the barrel section 20, and while bolt immobilization is carried out, such the head section 22 The barrel section 20 with the mounting bolt 27 arranged in two or more flange projections 26 While being constituted with the approximate circle column configuration in the air in which it is being fixed to the top face of the base element 13, with the cylinder part material 14 carries out opening to the upper part in a feed hole 28, it is attached in location immobilization to the top face of the base element 13.

[0030] On the other hand, the large piston 16 is presenting the shape of a cylindrical shape with \*\*\*\* of the shape of longitudinal-section reverse of T characters by which the lower part was major-diameter-sized as a whole, and while the lower part equivalent to the head of T characters is made into the sliding section 32, let the up part equivalent to the leg of T characters be a shank 34. Moreover, an outer diameter with the sliding section 32 of this large piston 16 slightly smaller than the bore of the barrel section 20 of the cylinder part material 14. It has slightly low height and consists of the height from the base of the barrel section 20 in the cylinder part material 14 to the underside of the head section 22. Further a shank 34 It has a slightly small outer diameter and height bigger enough than the thickness dimension of the head section 22, and consists of diameters of feed-hole 28 opening in the head section 22 of the cylinder part material 14.

[0031] And such a large piston 16 is held in the barrel section 20 of the cylinder part material 14 in the sliding section 32. In and the condition of having made the up part of a shank 34

projecting up, through the feed hole 28 of the head section 22 of this cylinder part material 14 In shaft orientations, it can move now up and down, being arranged in the cylinder part material 14, and sliding on the inner skin of the barrel section 20 in the peripheral face of the sliding section 32 under such an arrangement condition.

[0032] In addition, the migration to the upper part of this large piston 16 is regulated by contact of the top face of the sliding section 32 to the underside of the head section 22 of the cylinder part material 14, and migration in the lower part is regulated by contact of the underside of the sliding section 32 to the base of the barrel section 20 of the cylinder part material 14 here (refer to drawing 2 ). And it considers as the large oil pressure room 36 as second oil pressure room the pressure oil 23 with which the inside space of the cylinder part material 14 formed under the sliding section 32 is supplied in the barrel section 20 through the aforementioned style oil gallery 24 by the migration to the upper part of the large piston 16 is made to introduce. In this way, with this operation gestalt, magnitude of the pressure acceptance side (underside of the sliding section 32 of the large piston 16) which receives the oil pressure you are made to produce in this large oil pressure room 36 by installation of the pressure oil 23 into the large oil pressure room 36 is enlarged enough so that the migration stroke of the large piston 16 may be made comparatively small and it may mention later.

[0033] By the way, the insertion hole 38 which penetrates a shank 34 and the sliding section 32 to shaft orientations, and is prolonged is formed in the core of the large piston 16 arranged in the cylinder part material 14 in this way. This insertion hole 38 consists of the circular hole with a stage with which the connection 44 which connects the shank side opening 40 and the sliding section side opening 42 was formed into the predetermined dimension minor diameter rather than the double door regio oralis 40 and 42. And the cylinder metallic ornaments 46 are arranged in the part which penetrates the sliding section 32, i.e., the lower part of the insertion hole 38 including some connections 44 which follow the sliding section side opening 42 and it, in such an insertion hole 38. The shape of a small cylindrical shape is presented. namely, the inside configuration of a continuation part with the sliding section side opening 42 of the connection [ in / as a whole / in these cylinder metallic ornaments 46 / the insertion hole 38 ] 44 -- a 1-round person -- A flange 48 is really formed in a soffit peripheral face, and became it, and it is fixed to the large piston 16 with the bolt inserted in the flange 48 under the condition inserted in the lower part of the insertion hole 38, making this flange 48 arrange in the sliding section side opening 42.

[0034] moreover, such cylinder metallic ornaments 46 -- upper part side opening -- a predetermined dimension -- thin -- smallness -- it has the inner hole 51 used as the constriction opening 50 it comes--izing [ opening ]. And the ball valve 52 which has a bigger path than the diameter of opening of the constriction opening 50 in this inner hole 51 smaller enough than that bore It holds in the vertical direction movable. Under the ball valve 52 A helical compression spring 54 makes the lower peripheral face of a ball valve 52 stop the upper bed section, and is arranged in the condition of carrying out the precompression of it, making the upper bed side of the approximately cylindrical stop metallic ornaments 56 screwed on lower part side opening of an inner hole 51 stopping the soffit section. By this, unless bigger external force than the energization force of a helical compression spring 54 has \*\*\*\* straw to a ball valve 52 in the insertion hole 38 As opposed to a ball valve 52 the constriction opening 50 in the inner hole 51 of the cylinder metallic ornaments 46 -- a ball valve 52 -- liquid, while being made to blockade densely Bigger external force than the energization force of a helical compression spring 54 in the \*\*\*\*\* case A ball valve 52 resists the energization force of a helical compression spring 54, it is made to move caudad, and lock out of the constriction opening 50 by the ball valve 52 is canceled, with the constriction opening 50 carries out opening toward the inside of the connection 44 of said insertion hole 38.

[0035] Furthermore, \*\*\*\*\* 58 to which the pressure oil 23 which consists of pore prolonged to these shaft orientations succeeding a right-angled direction can circulate is formed at least in the shaft-orientations pars intermedia at the sliding section 32 of the large piston 16 which gives the lower part of the insertion hole 38 in which the writing \*\*\*\* cylinder metallic ornaments 46 are arranged. And this \*\*\*\*\* 58 is constituted so that opening may be carried out to the inner skin of the insertion part of said cylinder metallic ornaments 46 and the

peripheral face of the sliding section 32 in the connection 44 of the insertion hole 38 and it may be open for free passage in peripheral face side opening of this sliding section 32 to \*\*\*\*\* 24 in the barrel section 20 of said cylinder part material 14. The pressure oil 23 introduced from the outside through \*\*\*\*\* 24 flows \*\*\*\*\* 58, passes along the clearance between the inner skin of the sliding section 32 which gives the connection 44 of the insertion hole 38, and the peripheral face of said cylinder metallic ornaments 46 further, and is made to flow in the building envelope of the insertion hole 38 by this. And like the above-mentioned, it carries out, and only within the case where the lock out by the ball valve 52 of the constriction opening 50 of said cylinder metallic ornaments 46 is canceled, the pressure oil 23 led in the building envelope of the insertion hole 42 passes along the inner hole 51 of these cylinder metallic ornaments 46, and is introduced in said large oil pressure room 36. In addition, one articles of thin circumferential grooves can be formed at a time in the location whose opening of \*\*\*\*\* 58 in the peripheral face of the sliding section 32 was pinched up and down, respectively, and O ring 60 can be respectively arranged one [ at a time ] in each [ these ] circumferential groove, with a break through of the pressure oil 23 out of the free passage part of \*\*\*\*\* 24 and \*\*\*\*\* 58 or the large oil pressure room 36 can prevent now here.

[0036] Moreover, it sets in the sliding section 32 of the large piston 16. As the circular slot 62 which has the comparatively shallow depth and predetermined width of face encloses a shank 34 in the inner circumference section on top, it is formed in it. In this circular slot 62 In the condition that one thing was made reversed, in each circular hole, two belleville springs 64 and 64 as first energization means which present the shape of a taper cartridge with low height, and have a circular hole in a core are extrapolated by the shank 34, respectively, and are held in it. And if it is in these two belleville springs 64 and 64 While piling up in the vertical direction in the circular slot 62, the edge outside surface by the side of each minor diameter contacting mutually In the condition that the periphery edge of the belleville spring 64 which the periphery edge of the belleville spring 64 located in an upside is made to engage with the underside of the head section 22 of the cylinder part material 14, and is located in the bottom was made to engage with the base of said circular slot 62 in the large piston 16 You are in the condition carry out a precompression to shaft orientations, and it is arranged, with the large piston 16 was made to energize caudad by the energization force of two belleville springs 64 and 64, and it is made to be located in the cylinder part material 14.

[0037] in this way -- the inside of the cylinder part material 14 -- setting -- the upper and lower sides, if it is in the large piston 16 arranged movable It is made to move caudad by the energization force of two belleville springs 64 and 64. Moreover, under the migration condition to such a lower part When the pressure oil 23 which was supplied from the outside through \*\*\*\*\* 24 and led in the building envelope of the insertion hole 42 is introduced in the large oil pressure room 36 through the inner hole 51 of the cylinder metallic ornaments 46, with the oil pressure you are made to produce in this large oil pressure room 36 You resist the energization force of two belleville springs 64 and 64, and it is made to move up.

[0038] On the other hand, the small piston 18 is presenting the shape of a cylindrical shape with \*\*\*\* by which the part of upside one half was major-diameter-ized as a whole, and while at least the major diameter of upside one half is used as the shank 74, let at least the narrow diameter portion of bottom one half be the sliding section 76. And if it is in this small piston 18, only the predetermined dimension of the whole die length is longer than the shank side opening 40 of said insertion hole 38 prepared in the large piston 16. And while being made shorter enough than the die length from the underside of the lock out plate 66 which blockades this shank side opening 40 up opening to the top face of said cylinder metallic ornaments 46 arranged in the lower part of this insertion hole 38 The outer diameter of a shank 74 is made smaller enough than the bore of this shank side opening 40, and the outer diameter of the sliding section 76 is slightly made smaller than the bore of said connection 44 of this insertion hole 38. Such a small piston 18 at least the point of the sliding section 76 in and the condition that you made it rush in into the connection 44 of the insertion hole 38 Being inserted in in the shank side opening 40 of this insertion hole 38, with sliding on the inner skin of a connection 44 in the peripheral face of the sliding section 76, it is in the condition which can carry out predetermined dimension migration of the inside of the insertion hole 38 up and down in shaft

orientations, and is arranged inside the large piston 16.

[0039] In addition, the migration to the upper part of this small piston 18 is regulated by contact of the top face of the shank 74 to the underside of said lock out plate 66 (refer to drawing 1), and migration in the lower part is regulated by contact of the underside of the sliding section 76 to the top face of said cylinder metallic ornaments 46 here (refer to drawing 2 ). And it considers as the small oil pressure room 78 as first oil pressure room where the pressure oil 23 with which the space in the connection 44 of the insertion hole 38 formed between the underside of the sliding section 76 and the top face of the cylinder metallic ornaments 46 is supplied in the building envelope of the insertion hole 38 through the aforementioned style oil gallery 24 and \*\*\*\*\* 58 by the migration to the upper part of the small piston 18 is introduced. With this operation gestalt, magnitude of the pressure acceptance side (underside of the sliding section 76 of the small piston 18) which receives the oil pressure you are made to produce in this small oil pressure room 78 by installation of the pressure oil 23 into the small oil pressure room 78 is enlarged enough by this as compared with it of the large piston 16 so that the migration stroke of the small piston 18 may be enlarged enough and it may mention later. In addition, 80 are an O ring which prevents a break through of the pressure oil 23 introduced into the small oil pressure room 78 among drawing 1.

[0040] And opening is carried out to the upper part, the spring hold hole 84 which extends in shaft orientations is established in the core of such a shank 74 of the small piston 18, and the helical compression spring 86 as second energization means is arranged in this spring hold hole 84. While the end section is made to stop by the base of the spring hold hole 84, this helical compression spring 86 is in the condition the other end was made to stop by the underside of said lock out plate 66 which blockades up opening in the shank side opening 40 of the insertion hole 38 with which insertion arrangement of the small piston 18 is carried out, the precompression of it is carried out to shaft orientations, and it is arranged, with the small piston 18 is made to energize it caudad by the energization force of a helical compression spring 86.

[0041] If it is in the small piston 18 arranged movable in the vertical direction in the insertion hole 38 of the large piston 16 in this way It is made to move caudad by the energization force of a helical compression spring 86. Moreover, under the migration condition to such a lower part When the pressure oil 23 supplied from the outside through \*\*\*\*\* 24 is introduced in the small oil pressure room 78 through \*\*\*\*\* 58, you resist the energization force of a helical compression spring 86, and it is made to move up by the oil pressure you are made to produce in this small oil pressure room 78.

[0042] Especially with this operation gestalt, and the helical compression spring 54 arranged in the inner hole 51 of said cylinder metallic ornaments 46 Although it is not made to compress until pressure oil 23 is full in the small oil pressure room 78, when pressure oil 23 is made to introduce further in the small oil pressure room 78 full of pressure oil 23, it has the energization force of magnitude you are made to compress by the oil pressure produced in this small oil pressure room 78, and is constituted. Moreover, the outer diameter which can rush into the core of the underside of the sliding section 76 in the small piston 18 into the constriction opening 50 of said cylinder metallic ornaments 46, The projection 82 which has long die length is formed in one. the die length of this constriction opening 50 -- a predetermined dimension -- by it When the small piston 18 is made to be located by the migration edge to the lower part which makes the underside contact the top face of the cylinder metallic ornaments 46 The ball valve 52 in the inner hole 51 of the cylinder metallic ornaments 46 is pressed by projection 82, resists the energization force of a helical compression spring 54, and it is made to move caudad, with the lock out by the ball valve 52 of the constriction opening 50 in this inner hole 51 is canceled.

[0043] Therefore, the large piston 16 and the small piston 18 set under the condition that you were made to be located, respectively by the migration edge to a lower part. When \*\*\*\*\* 24 is connected to the hydraulic pump which is not illustrated and pressure oil 23 is supplied from the outside through \*\*\*\*\* 24 First, this pressure oil 23 flows \*\*\*\*\* 58, and is introduced in the small oil pressure room 78 through the clearance between the inner skin of a connection 44 and the peripheral faces of the cylinder metallic ornaments 46 in the insertion hole 38. The small piston 18 resists the energization force of the helical compression spring 86 arranged in

the shank 74, and is made to move up with a big stroke by the oil pressure produced in the small oil pressure room 78 with installation of such pressure oil 23. In addition, since constriction opening 50 of the cylinder metallic ornaments 46 is carried out [ that you were freely made to blockade by the ball valve 52, and ] at this time, pressure oil 23 does not flow in the large oil pressure room 36 (refer to drawing 4 ).

[0044] If pressure oil 23 is made full in the small oil pressure room 78 and the small piston 18 arrives at the migration edge to the upper part by introducing pressure oil 23 in the small oil pressure room 78, with then, the oil pressure in this small oil pressure room 78 The ball valve 52 in the inner hole 51 of the cylinder metallic ornaments 46 resists the energization force of a helical compression spring 54, is made to move caudad, and the lock out by the ball valve 52 of the constriction opening 50 in this inner hole 51 is canceled. The large piston 16 resists the energization force of two belleville springs 64 and 64, and is made to move up by slight stroke by the oil pressure which pressure oil 23 is introduced in the large oil pressure room 36 through this inner hole 51, and produces in the large oil pressure room 36 in connection with it by this. and the bulb between said hydraulic pumps and \*\*\*\*\* 24 (not shown) is closed under the condition that pressure oil 23 was made full in the large oil pressure room 36, and the large piston 16 was made to reach whenever [ to the upper part / motion limit ] by the location -- carrying out -- \*\*\*\*\* 24 -- liquid -- when blockaded densely, the constriction opening 50 is made to blockade again by the ball valve 52, as shown in drawing 1

[0045] In the bottom of the condition that the large piston 16 and the small piston 18 were made to be located on the other hand in this way, respectively by the migration edge to the upper part When said bulb is opened under a halt of a hydraulic pump and lock out of \*\*\*\*\* 24 is canceled First, the small piston 18 is made to move caudad by the energization force of a helical compression spring 86, and in connection with it, the pressure oil 23 in the small oil pressure room 78 passes along \*\*\*\*\* 58, and is discharged outside from \*\*\*\*\* 24 (refer to drawing 2 ). and -- if the pressure oil 23 in the small oil pressure room 78 is discharged altogether and the small piston 18 arrives at the migration edge to a lower part -- the above-mentioned \*\*\*\* -- by like and the projection 82 prepared in the underside of the small piston 18 The lock out by the ball valve 52 of the constriction opening 50 in the cylinder metallic ornaments 46 is canceled. The large piston 16 is made to move caudad by the energization force of two belleville springs 64 and 64. In connection with it, the pressure oil 23 in the large oil pressure room 36 is made to flow toward the inside of the small oil pressure room 78 through the inner hole 51 of the cylinder metallic ornaments 46, and is further discharged outside through \*\*\*\*\* 58 and \*\*\*\*\* 24 (refer to drawing 3 ). And when the pressure oil 23 in the large oil pressure room 36 is discharged altogether, the large piston 18 is made to reach by the migration edge to a lower part. The free passage hole with which the inlet which introduces pressure oil into the first oil pressure interior of a room from the outside, and the exhaust port which discharges the pressure oil of this first oil pressure interior of a room outside consist of \*\*\*\*\* 24, and opens the first oil pressure room and the second oil pressure room for free passage consists of these operation gestalten in the inner hole 51 of the cylinder metallic ornaments 46 so that clearly from these things.

[0046] Moreover, in here, the breakthrough 68 which penetrates this barrel wall and is prolonged in a right-angled direction to shaft orientations is formed in two or more [ in the large piston 16 constituted with the migration structure like \*\*\*\*, and the small piston 18 / which give the shank side opening 40 of said insertion hole 38 in the projection part from the cylinder part material 14 to the shank 34 of the large piston 16 / of the same height of a barrel wall ], respectively. And into each [ these ] breakthrough 68, if it puts in another way, hold arrangement of the steel ball 70 as a migration member is carried out one [ at a time ] in the extension direction of each breakthrough 68, and the condition that you slide or roll and may be made to move in the right-angled direction to shaft orientations, respectively. Each [ these ] steel ball 70 has predetermined dimension size \*\*\*\*\*, and consists of extension lay length dimensions of a breakthrough 68. Moreover, by it In the condition that you are not made to project in any way from peripheral face side opening of the shank 34 in a breakthrough 68 On the other hand (refer to drawing 1 ), a part is made to project from a shank 34 in the condition that you are not made to project in any way from inner skin side opening of the shank 34 in a

breakthrough 68 whose part is made to project in the shank side opening 40 by the side (refer to drawing 2 ).

[0047] in addition, in the opening edge of each breakthrough 68 in the peripheral face of the shank 34 of this large piston 16 The rubber ring 72 which has a bore slightly smaller than the diameter of opening has fixed, respectively. By it For example, when the first conclusion object 10 is leaned or it is pushed down, the steel ball 70 is made to contact the inside part of a rubber ring 72, and secedes from a breakthrough 68 easily outside. Moreover, one articles of thin circumferential grooves are formed in the lower part in the peripheral face of the shank 34 of the large piston 16, and O ring 60 is arranged also in this circumferential groove.

[0048] And the lobe 88 which follows a predetermined height projection and a hoop direction, and is prolonged is formed in the direction of a path at the upper bed section of the shank 74 of the small piston 18. If it is in this lobe 88, while considering as the maintenance side 89 which has an outer diameter with that peripheral face slightly smaller than the bore of the shank side opening 40 in the insertion hole 38 of the large piston 16 In the bottom of the condition that the underside is made into the press side 90 which presents the taper side configuration which serves as a major diameter gradually as it goes up, and the small piston 18 was made to be located in it by the upper migration edge While being made to be located in the press side 90 of this lobe 88 by the same height as each breakthrough 68 prepared in the shank 34 of the large piston 16 (refer to drawing 1 and drawing 4 ) \*\* made to be located in the maintenance side 89 of this lobe 88 in the condition that the small piston 18 was made to be located by the downward migration edge by the same height as each [ these ] breakthrough 68 -- it is like (refer to drawing 2 and drawing 3 ).

[0049] Furthermore, it sets under the condition that the small piston 18 resisted the energization force of said helical compression spring 86, and you were made to be located with this operation gestalt as shown in drawing 1 by the migration edge to the upper part. While each steel ball 70 arranged in each breakthrough 68 of the shank 34 of the large piston 16 makes the part project in the shank side opening 40 and being made it to be located In this projection part, it is constituted so that it may be made to contact to the press side 90 in the shank 74 of the small piston 18.

[0050] The small piston 18 from the migration end position to the upper part therefore, by being made to move caudad by the energization force of a helical compression spring 86 The steel ball 70 arranged in each breakthrough 68 is pressed in the direction right-angled to shaft orientations in respect of [ 90 ] the press made into the taper side configuration like the above-mentioned, and is made to move in the inside of each breakthrough 68 toward peripheral face side opening of the shank 34 of the large piston 16 in this breakthrough 68. And when the small piston 18 arrives at the migration edge to a lower part, while some each steel ball 70 is made to project from a shank 34 through peripheral face side opening of the shank 34 in a breakthrough 68 by the side, such a projection condition is held in respect of [ 89 ] maintenance of a lobe 88 (refer to drawing 2 ). The cam mechanism which makes the press side 90 a cam side consists of these operation gestalten between the small piston 18 and each steel ball 70 so that clearly from this.

[0051] On the other hand, the second conclusion object 12 is presenting the shape of a cylindrical shape as the whole which has the inner hole of the magnitude which can insert in the shank 34 of the large piston 16 in the first conclusion object 10. Moreover, the engagement projected part 92 prolonged toward the method of the inside of the direction of a path succeeding a predetermined height projection and a hoop direction is formed in the shaft-orientations pars intermedia in the inner skin of the second conclusion object 12 of the shape of this cylinder in one. This engagement projected part 92 consists of the outer diameter of the shank 34 of the large piston 16 with the slightly big bore, and while that top face is made into the engagement side 94 which has the taper side configuration which serves as a minor diameter gradually as it goes caudad, it is made into the contact surface 96 where that underside consists of the level surface. And if it is in such second conclusion object 12, it is attached in location immobilization to the underside of the fixture plate 11 with two or more mounting bolts 100 arranged by the outside flange 98 really formed in the lower peripheral face.

[0052] When the fastener of this operation gestalt which has the first conclusion object 10

made into the second conclusion object 12 and the structure like the above-mentioned of having a \*\*(ing) and writing \*\*\*\* configuration is used, conclusion with the fixture plate 11 and the base element 13 and its discharge will be performed as follows, for example.

[0053] That is, first, as shown in drawing 1, opposite arrangement of the base element 13 and the fixture plate 11 is carried out so that the first conclusion object 10 and the second conclusion object 12 which were fixed to them, respectively may estrange mutually and it may be located in same axle. And by carrying out [ above-mentioned ] like [ \*\*\*\* ] and making pressure oil 23 full in the inside of the large oil pressure room 36 of the first conclusion object 10 fixed to the base element 13, and the small oil pressure room 78 under such an arrangement condition While resisting the energization force of two belleville springs 64 and 64 and helical compression springs 86 and making it the large piston 16 and the small piston 18 located in the migration edge to the upper part, respectively Make the steel ball 70 in each breakthrough 68 of the large piston 16 project in the shank side opening 40 of the insertion hole 38 in which it was prepared by this large piston 16, and you make the press side 90 in the shank 74 of the small piston 18 contact in the projection part, and make it located. In addition, each steel ball 70 does not need to be made not to be made to project in any way from the first conclusion object 10 at this time by that side.

[0054] Subsequently, the second conclusion object 12 is made to attach outside the projection part of the shank 34 of the large piston 16 made to project from the cylinder part material 14 in the first conclusion object 10, as shown in drawing 2. The contact surface 96 of the engagement projected part 92 of the second conclusion object 12 makes the outside attachment location to the first conclusion object 10 of the second conclusion object 12 at this time the location made to contact the level top face of the cylindrical projection 30 in the cylinder part material 14 of the first conclusion object 10.

[0055] Then, under the outside attachment condition to the first conclusion object 10 of this second conclusion object 12, by canceling the state of obstruction of \*\*\*\*\* 24 in the first conclusion object 10, the small piston 18 is made to move caudad according to the energization force of a helical compression spring 86, and the pressure oil 23 in the small oil pressure room 78 is discharged outside through \*\*\*\*\* 58 and \*\*\*\*\* 24. Moreover, each steel ball 70 made to project like the above-mentioned with migration in the lower part of this small piston 18 with it in the shank side opening 40 of said insertion hole 38 is pressed according to the press side 90 of the lobe 88 of the small piston 16. it moves in the inside of each breakthrough 68 -- making -- a part of each [ these ] steel ball 70 of each -- a part is made to project from the shank 34 10 of the large piston 16, i.e., the first conclusion object, in the side through peripheral face side opening of the shank 34 in a breakthrough 68 And the projection part of each steel ball 70 is made to engage with the engagement side 96 of the engagement projected part 94 in the second conclusion object 12 by moving the small piston 18 below further and making it arrive at a downward migration edge. In addition, each steel ball 70 sets at least to a reverse flank with that projection side, and is made to contact the maintenance side 89 of the lobe 88 of the small piston 18, and the projection condition from the first conclusion object 10 of each steel ball 70 is made to hold at this time by it.

[0056] Subsequently, by carrying out like \*\*\*\* and making the small piston 18 arrive at the migration edge to a lower part, as shown in drawing 3 Cancel the lock out by the ball valve 52 of the constriction opening 50, and the large piston 16 is made to move caudad according to the energization force of two belleville springs 64 and 64. The pressure oil 23 in the large oil pressure room 36 is made to flow toward the inside of the small oil pressure room 78 through the inner hole 51 of the cylinder metallic ornaments 46, and is further discharged outside through \*\*\*\*\* 58 and \*\*\*\*\* 24. Each steel ball 70 is caudad pressed in the upside inner skin of each breakthrough 68 of the large piston 16 with migration in the lower part of such a large piston 16. And by that cause Between the projection part of each steel ball 70 which engaged with the engagement side 96 of the engagement projected part 94 in the second conclusion object 12, and the top face of the cylindrical projection 30 of said cylinder part material 14 The base element 13 to which the engagement projected part 94 of the second conclusion object 12 was clamped by the clamp force based on the thrust to the lower part to each steel ball 70, with the first conclusion object 10 was fixed, the fixture plate 11 with which the second

conclusion object 12 was fixed -- shaft orientations -- it is, and up and down, it is in an unmovable condition and concludes mutually. In addition, although each steel ball 70 receives the applied force which acts toward the inside of the shank side opening 40 of said insertion hole 38 based on the reaction force of the thrust to the engagement side 96 made into the taper side configuration of the engagement projected part 94 at this time, migration into the insertion hole 38 will be prevented by the contact to said maintenance side 89.

[0057] Moreover, in order to cancel the conclusion condition of such a fixture plate 11 and the base element 13, the pressure oil 23 supplied from a hydraulic pump etc. is introduced in the small oil pressure room 78 through \*\*\*\* 24 and \*\*\*\* 58, the energization force of a helical compression spring 86 is resisted, and the small piston 18 is made to move up first, with the oil pressure produced in this small oil pressure room 78, as shown in drawing 4. According to said applied force which is made to cancel contact on the maintenance side 89 of the lobe 88 of the small piston 18, and each steel ball 70, and is made to act to each [ these ] steel ball 70 like \*\*\*\* by it Level-luffing-motion migration of each steel ball 70 is carried out toward the inside of the shank side opening 40 of the insertion hole 38 into each breakthrough 68. With, while canceling the engagement of each steel ball 70 to the engagement side 96 of the engagement projected part 94 in the second conclusion object 12, the clamp of this engagement projected part 94 between each steel ball 70 and the top face of the cylindrical projection 30 of the cylinder part material 14 is also made to cancel.

[0058] And conclusion with the fixture plate 11 and the base element 13 is canceled after that by making it the small piston 18 located in the migration edge to the upper part, and making it the second conclusion object 12 and the first conclusion object 10 displaced relatively in the vertical direction under the condition of carrying out level-luffing-motion migration of each steel ball 70 to the location which does not project at all in the side from the first conclusion object 10.

[0059] In this operation gestalt, introduce pressure oil 23 in the small oil pressure room 78 and the large oil pressure room 36, and with thus, both [ these ] the oil pressure room 78 and the oil pressure produced within 36 Although the conclusion condition of the fixture plate 11 and the base element 13 is canceled by resisting the energization force of a helical compression spring 86 and two belleville springs 64 and 64, and making it move up, the small piston 18 and the large piston 16 Have the pressure acceptance side of like, and the migration stroke with the big small piston 18 and a small area, and it is constituted. the above-mentioned \*\*\*\* -- Moreover, from the place where the large piston 16 changes with the small migration stroke and the pressure acceptance side of a big area, in order for the conclusion condition of the fixture plate 11 and the base element 13 to make it cancel In the conventional fastener with which the total quantity of the pressure oil 23 introduced in the small oil pressure room 78 and the large oil pressure room 36 comes to have one piston to which each of migration strokes and area of a pressure acceptance side was set greatly Rather than the amount of the pressure oil by which the need is carried out to making the conclusion condition of two concluded members cancel, it can stop few very effectively.

[0060] Therefore, if it is in the fastener of such this operation gestalt For example, when concluding the fixture plate 11 and the base element 13 of a large area, it sets. Even if plurality is used, it is not necessary to use pressure oil 23 for a large quantity for the large-sized hydraulic pump in which the regurgitation is possible at all. By it It becomes possible to be able to raise workability advantageously, in case the fixture plate 11 and the base element 13 of these large areas are made to conclude, and to reduce the activity cost advantageously.

[0061] In this fastener, the press side 90 which is constituted from an underside of a lobe 88 by the upper bed section of the small piston 18 and which presents a taper side configuration is established. Moreover, by migration in the lower part of the small piston 18 Each steel ball 70 is pressed in respect of [ 90 ] this press, and from the place made to project from the first conclusion object 10 by the side, the projection migration from the first conclusion object 10 of each steel ball 70 is very simple structure, and may be realized certainly.

[0062] If it is in the fastener of this operation gestalt, the small piston 18 furthermore, in the insertion hole 38 formed in the shank 34 of the large piston 16 since it is arranged that it is movable and in same axle up and down in shaft orientations, the small piston 18 arranges in the

first conclusion object 10, without taking a location -- having -- obtaining -- it -- the first conclusion object 10, as a result fastener whole -- advantageous -- small -- it may miniaturize.

[0063] In this fastener, moreover, two or more steel balls 70 which carry out projection level-luffing-motion migration toward the side from the first conclusion object 10 From the place arranged in two or more breakthroughs 68 formed in the shank 74 of the small piston 18 The arrangement tooth space of the small piston 18 and the large piston 16 does not independently need to provide the arrangement tooth space between two or more steel balls 70, and small [ of the first conclusion object 10 and the whole fastener ] and miniaturization may be attained more by it at validity.

[0064] By furthermore, closing motion of the constriction opening 50 of this inner hole 51 by the ball valve 52 arranged in the inner hole 51 of the cylinder metallic ornaments 46 which open the small oil pressure room 78 and the large oil pressure room 36 for free passage if it was in this fastener Since it begins and pressure oil 23 is introduced in the large oil pressure room 36 after pressure oil 23 is made full by the small oil pressure room 78, pressure oil 23 may be made more certainly full to each of the small oil pressure room 78 and the large oil pressure room 36.

[0065] Furthermore, it sets to the fastener of this operation gestalt again. When the pressure oil 23 in the small oil pressure room 78 is discharged altogether and the small piston 18 is made to be located by the migration edge to a lower part By making the ball valve 52 in the inner hole 51 of the cylinder metallic ornaments 46 move caudad by the projection 82 prepared in the underside of this small piston 18 The large oil pressure room 36 being made open for free passage by the small oil pressure room 78, and the pressure oil 23 in the large oil pressure room 36 being made to discharge through the small oil pressure room 78 From the place to which the large piston 16 is made to move caudad Each steel ball 70 begins, after being made to engage with the engagement projected part 92 of the second conclusion object 12. This engagement projected part 92 between each steel ball 70 and the cylinder part material 14 of the first conclusion object 10 It may be clamped with the predetermined clamp force. By it Before each steel ball 70 is fully engaged to the engagement projected part 92, it may be prevented advantageously that the clamp force over the engagement projected part 92 is made to arise between each steel ball 70 and the cylinder part material 14. And they become possible [ concluding that it is very good and certainly the fixture plate 11 fixed, respectively and the base element 13 ] with the first conclusion object 10 and the second conclusion object 12 as the result.

[0066] As mentioned above, although the concrete configuration of this invention has been explained in full detail, this is only instantiation to the last, and this invention does not receive any constraint by the above-mentioned publication, either.

[0067] for example, -- said operation gestalt -- the first piston -- a member -- the small piston 18 -- the second piston -- a member -- although arranged in the insertion hole 38 formed in the shank 34 of the large piston 16, if this first piston member is made to move to shaft orientations, the arrangement structure will not be limited to this at all. Moreover, it is a place needless to say that it is not what is especially limited to that the arrangement structure of the second piston member is also indicated to be to said operation gestalt.

[0068] Furthermore, although the migration member was constituted from said operation gestalt by the steel ball 70 This migration member by migration to the shaft orientations of the first piston member by the energization force of the first energization means That what is necessary is to move in the right-angled direction to these shaft orientations, and to just be constituted so that projection migration may be carried out from the first conclusion object therefore, even if it constitutes this migration member from a suitable koro member and a suitable plate, or a block object, it does not interfere at all. Moreover, as long as such the arrangement number of a migration member does not necessarily have to be made into plurality, either and can clamp the second conclusion object certainly between the first conclusion object, you may make it arrange only one.

[0069] moreover, the first and second energization means which the first and second piston members are alike, respectively, and receive and do the predetermined energization force are not limited especially, either, and a well-known energization means replaces with what is shown

in said operation gestalt, and may be adopted suitably.

[0070] furthermore, the first and second oil pressure rooms which the these firsts and second piston members are alike, respectively, and receive and do oil pressure may also be suitably changed for the arrangement location, arrangement structure or a configuration, the number, etc. according to the first and second arrangement gestalten of a piston member etc.

[0071] Furthermore, although it consisted of said operation gestalten again so that it might be made for the second conclusion object 12 to be attached outside to the first conclusion object 10 and it might be together put in the vertical direction By preparing a predetermined fitting hole, inserting in the second conclusion object in this fitting hole, and fitting into the first conclusion object Of course, it is also possible to constitute so that it may combine in a direction which combines the first conclusion object and the second conclusion object, or is different from the vertical directions, such as a longitudinal direction, in the conclusion object of them first and the second conclusion object. In addition, toward the inside of a fitting hole, when adopting the fitting structure which inserts in the second conclusion object and fits in in the fitting hole of the first conclusion object, a migration member will be constituted so that it may be made to move to a way among the first conclusion object.

[0072] In addition, although are applied to the fastener used in order to conclude mutually the base element and fixture plate in which this invention is attached by the table of machine tools, such as a machining center, and the example was shown with said operation gestalt Of course, it is what may be advantageously applied also to the fastener used in order that this invention may conclude mutually two various members which should be concluded.

[0073] In addition, although listing is not carried out one by one, unless this invention may be carried out in the mode which added modification which becomes various based on this contractor's information, correction, amelioration, etc. and such an embodiment deviates from the meaning of this invention, it is a place needless to say that it is that by which all are contained within the limits of this invention.

[0074]

[Effect of the Invention] If the fastener according to this invention is used so that clearly also from the above explanation When the amount of the pressure oil needed for canceling the conclusion condition of two concluded members uses the conventional fastener, it compares.

[ in case you may make it decrease very advantageous and the members which have a large area are concluded, using a fastener two or more as the result ] While the workability at the time of being able to close pressure oil if there is no need of using for a large quantity the large-sized hydraulic pump in which the regurgitation is possible, with making these members conclude may be raised advantageously, the activity cost may be held down low effectively.

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[Translation done.]

## \*NOTICES\*

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the longitudinal-section explanatory view showing an example of a fastener according to this invention.

[Drawing 2] It is the explanatory view showing the busy condition of the fastener shown in drawing 1, and the condition of having made two or more steel balls made projecting from the first conclusion object engaging with the engagement projected part of the second conclusion object under the condition of having made the first conclusion object attaching the second conclusion object outside is shown.

[Drawing 3] It is the explanatory view showing another busy condition of the fastener shown in drawing 1, and between the projection part from the first conclusion object of two or more steel balls, and the first conclusion object cylinder part material, the engagement projected part of the second conclusion object is clamped, and the condition of having made the base element and fixture plate with which the first and second conclusion objects were fixed, respectively conclude mutually is shown.

[Drawing 4] It is the explanatory view showing still more nearly another busy condition of the fastener shown in drawing 1, and the condition of having canceled the engagement to the engagement projected part of two or more steel balls is shown from the conclusion condition of a base element and a fixture plate.

[Drawing 5] It is the explanatory view showing the busy condition of the conventional fastener, and the condition of having made the base element and fixture plate with which the first and second conclusion objects were fixed, respectively conclude mutually is shown.

[Drawing 6] It is the explanatory view showing other busy conditions of the fastener shown in drawing 5, and the condition of having canceled the conclusion condition of a base element and a fixture plate is shown.

[Description of Notations]

- 10 First Conclusion Object 11 Fixture Plate
- 12 First Conclusion Object 13 Base Element
- 14 Cylinder Part Material 16 Large Piston
- 18 Small Piston 36 Large Oil Pressure Room
- 38 Insertion Hole 51 Inner Hole
- 52 Ball Valve 64 Belleville Spring
- 68 Breakthrough 70 Steel Ball
- 78 Small Oil Pressure Room 86 Helical Compression Spring
- 90 Press Side 92 Engagement Projected Part

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[Translation done.]

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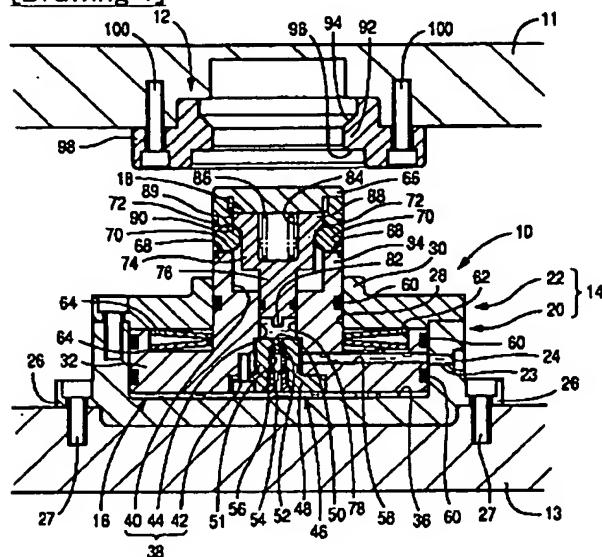
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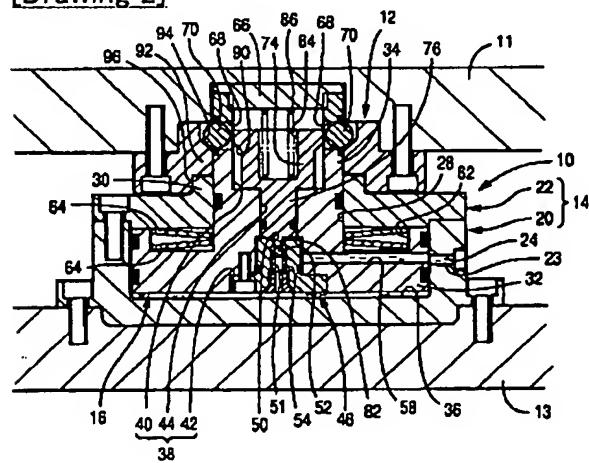
3. In the drawings, any words are not translated.

## DRAWINGS

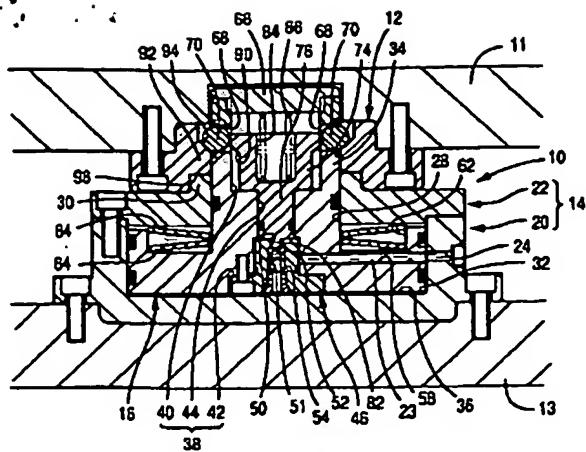
## [Drawing 1]



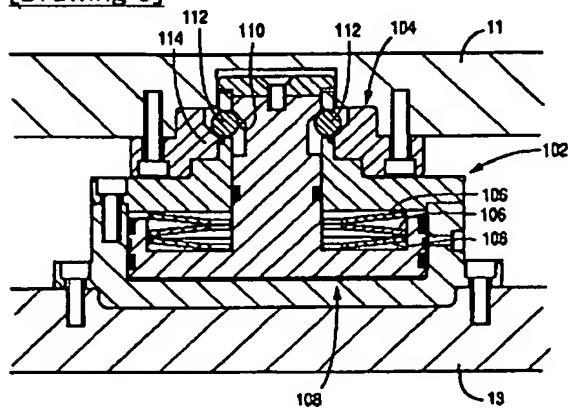
## [Drawing 2]



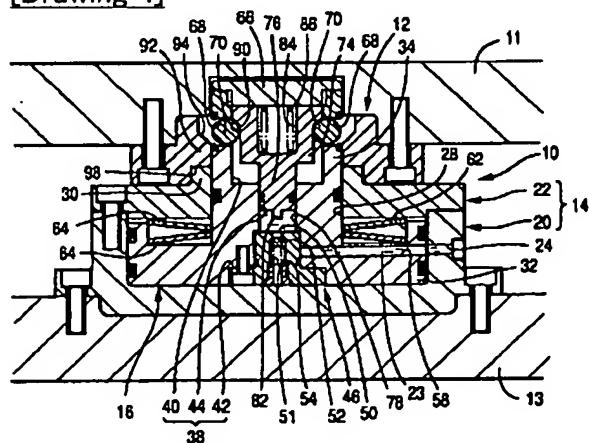
## [Drawing 3]



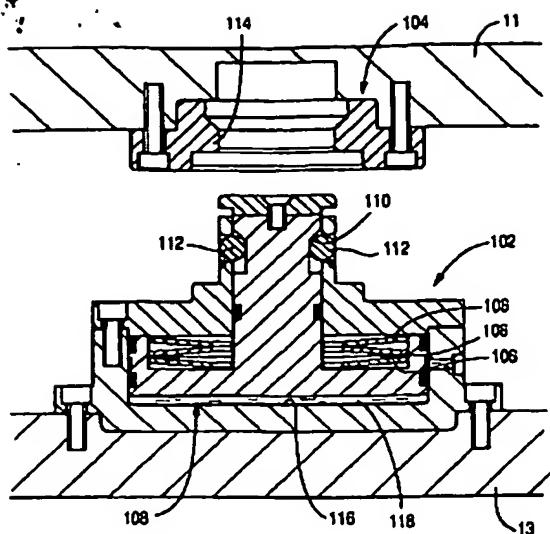
[Drawing 5]



[Drawing 4]



[Drawing 6]



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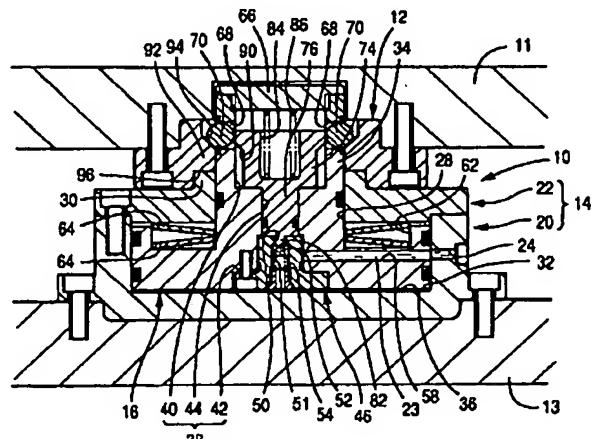
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(54)【発明の名称】 締結装置

(57)【要約】

【課題】 可及的に少ない圧油の量で、一方の締結体の他方の締結体に対するクランプを解除し、以てかかるクランプによる二つの部材の締結状態を解消し得る締結装置を提供する。

【解決手段】 第一及び第二の付勢手段86, 64のそれぞれの付勢力により軸方向一方側に移動せしめられ、且つ袖圧により軸方向他方側に移動せしめられる第一及び第二のピストン部材18, 16と、該第一のピストン部材18の軸方向一方側への移動に伴って突出移動せしめられる移動部材70とが設けられた第一の締結体10に対して、第二の締結体12を嵌合せしめた状態で、該第一のピストン部材18を軸方向一方側に移動せしめることにより、該移動部材70の該第一の締結体10からの突出部位を該第二の締結体12に係合せしめると共に、かかる突出部位と、該第二の締結体12の該第一の締結体10に対する接触部位との間で、該第二の締結体12をクランプして、それら第一及び第二の締結体10, 12がそれぞれ固定された二つの部材13, 11を相互に締結し得るように構成した。



## 〔特許請求の範囲〕

〔請求項1〕 締結されるべき二つの部材のうちの一方の部材に対して位置固定に取り付けられる第一の締結体と、該二つの部材のうちの他方の部材に対して位置固定に取り付けられ、該第一の締結体に対して嵌合せしめられる第二の締結体とを有すると共に、該第一の締結体に対して、第一及び第二の付勢手段のそれぞれの付勢力により軸方向一方側に移動せしめられ、且つ油圧により軸方向他方側に移動せしめられる第一及び第二のピストン部材と、該第一のピストン部材の軸方向一方側への移動により、該軸方向に対して直角な方向に移動して、該第一の締結体から突出せしめられる少なくとも一つの移動部材とが設けられる一方、前記第二の締結体に対して、該第一の締結体の移動部材に、その突出状態において係合可能な係合部が設けられて構成され、

それら第一の締結体と第二の締結体とを前記軸方向において嵌合するように組み合わせた状態下で、該第一のピストン部材を前記第一の付勢手段の付勢力により軸方向一方側に移動せしめて、前記移動部材を該第一の締結体から突出せしめることにより、該移動部材を前記第二の締結体の係合部に係合せしめる一方、該第二のピストン部材を前記第二の付勢手段の付勢力により軸方向一方側に移動せしめることによって、該第二の締結体の係合部に係合せしめられた該移動部材を該第二のピストン部材にて押圧し、該第二の締結体を、該移動部材と該第一の締結体の該第二の締結体に対する前記嵌合部位との間でクランプして、前記締結されるべき二つの部材を少なくとも前記軸方向に相対移動不能な状態で相互に締結するようにしたことを特徴とする締結装置。

〔請求項2〕 前記第一のピストン部材と前記移動部材との間に、該第一のピストン部材の軸方向の運動を該軸方向に対して直角な方向の運動に変換して該移動部材に伝達するカム機構が構成され、かかるカム機構により、該第一のピストン部材の前記軸方向一方側への移動に伴って、該移動部材が、該軸方向に対して直角な方向に移動せしめられて、前記第一の締結体から突出せしめられるようになっている請求項1に記載の締結装置。

〔請求項3〕 前記移動部材が、ポール部材にて構成されている請求項1又は請求項2に記載の締結装置。

〔請求項4〕 前記第二のピストン部材の軸部に、前記第一のピストン部材に対して及ぼされる前記油圧を圧油の導入により生ぜしめる第一の油圧室を与える、軸方向に延びる押通穴からなるシリンダ部が設けられて、かかる第二のピストン部材のシリンダ部内に、該第一のピストン部材が、該第一の油圧室内で生ぜしめられる油圧により前記軸方向他方側に移動せしめられ、且つ前記第一の付勢手段の付勢力により前記軸方向一方側に移動せしめられるように配置される一方、前記第一の締結体が、前記第二のピストン部材に対して及ぼされる前記油圧を

圧油の導入により生ぜしめる第二の油圧室を与えるシリンダ部材を更に有して構成されて、かかるシリンダ部材内に、該第二のピストン部材が、該第二の油圧室内で生ぜしめられる油圧により前記軸方向他方側に移動せしめられ、且つ前記第二の付勢手段の付勢力により前記軸方向一方側に移動せしめられるように配置されている請求項1乃至請求項3の何れかに記載の締結装置。

〔請求項5〕 前記第二のピストン部材における前記シリンダ部の、前記シリンダ部材から外方に突出せしめられた部位の側壁に、前記軸方向に対して直角な方向において該側壁を貫通して延びる貫通孔が形成されると共に、かかる貫通孔内に、前記移動部材が、該貫通孔の延びる方向に移動可能に配置され、該シリンダ部内での前記第一のピストン部材の前記軸方向一方側への移動により、かかる移動部材が、該貫通孔内をそれが延びる方向に移動せしめられて、該貫通孔の開口部から突出せしめられることにより、前記第一の締結体から突出せしめられるようになっている請求項4に記載の締結装置。

〔請求項6〕 前記第一の油圧室に、前記圧油を外部から導入する導入口を設けると共に、該第一の油圧室と前記第二の油圧室との間に、それらを連通する連通孔を設けて、該導入口から該第一の油圧室内に導入される圧油が、該連通孔を通じて該第二の油圧室に向かって流動せしめられるように構成する一方、該連通孔を液密に閉塞し得る弁体を、該第二の油圧室側から該第一の油圧室側に向かって付勢せしめられた状態で配置して、該第一の油圧室内に前記圧油が充満するまでは、該弁体にて該連通孔を液密に閉塞し、且つ該圧油が充満せしめられた第一の油圧室内に該圧油が更に導入せしめられた際には、該弁体を、それに作用せしめられる付勢力に抗して該第一の油圧室側から該第二の油圧室側に向かって移動させて、該連通孔の該弁体による閉塞を解消し得るように構成した請求項4又は請求項5に記載の締結装置。

〔請求項7〕 前記第一の油圧室に、その内部に導入された前記圧油を外部に排出する排出口を設けると共に、前記第一のピストン部材における前記軸方向一方側の先端に、前記連通孔内に挿通可能な突部を設けて、該第一の油圧室の圧油の全部を該排出口から外部に排出した状態下で、該第一のピストン部材を前記第一の付勢手段の付勢力により該軸方向一方側に移動せしめて、該第一のピストン部材の前記突部を前記連通孔内に挿通せしめることにより、該突部にて前記弁体を押圧し、それに作用せしめられる前記付勢力に抗して該第一の油圧室側から前記第二の油圧室側に向かって移動させて、該連通孔の該弁体による閉塞を解消せしめることにより、該第二の油圧室の前記圧油を該連通孔を通じて該第一の油圧室内に流動せしめ、更に前記排出口を通じて該第一の油圧室内から外部に排出せしめるように構成した請求項6に記載の締結装置。

〔発明の詳細な説明〕

## 【0001】

【技術分野】本発明は、所定の二つの部材を迅速に且つ容易に締結し得る締結装置に係り、特に、マシニングセンタ等の工作機械テーブルに取り付けられるベースエレメントと所定の治具が固定される治具プレートとを相互に締結するのに好適に用いられ得る締結装置に関するものである。

## 【0002】

【背景技術】従来より、二つの部材を締結するための締結装置としては、種々の構造のものがあり、それらの中から、締結されるべき部材の形状や用途等に応じて、適宜に選択されて、使用されている。そして、例えば、マシニングセンタ等の工作機械においても、様々な締結装置が用いられている。

【0003】すなわち、一般に、マシニングセンタ等の工作機械にあっては、加工されるべきワークを保持するため、クランプやバイス等の各種の治具が用いられているが、それらの治具は、その段取りを変えを容易に且つ迅速に行なわしめるために、多くの場合、治具プレートに固定されており、この治具プレートがベースエレメントに対して締結せしめられることによって、各種の治具が、ベースエレメントに取り付けられるようになっている。そして、それら治具プレートとベースエレメントとを相互に締結せしめるものとして、所定の締結装置が用いられているのである。

【0004】ところで、このような締結装置として用いられるものの一つとして、図5及び図6に示される如き構造を有する締結装置が、従来より知られている。この締結装置は、締結されるべき二つの部材としてのベースエレメント13と治具プレート11とに対して、それぞれ位置固定に取り付けられた第一の締結体102と第二の締結体104とを有している。また、第一の締結体102には、皿ばね106のばね力により軸方向一方側に移動せしめられ、且つ油圧により軸方向他方側に移動せしめられるピストン108と、該ピストン108の軸方向一方側への移動により、該ピストン108の外周面に形成されたテバ面形状の押圧面110にて外方に押圧されて、該軸方向に対して直角な方向に移動して、外方に突出せしめられる複数のスチールボール112とが配設されている。一方、第二の締結体104には、第一の締結体102における複数のスチールボール112に、その外方への突出状態下において係合可能な係合部114が設けられている。

【0005】そして、かかる締結装置にあっては、第二の締結体104を第一の締結体102に外嵌せしめて、それらを軸方向において互いに接触するように組み合せた状態下で、ピストン108を皿ばね106のばね力により軸方向一方側に移動せしめて、複数のスチールボール112を外方に突出せしめることにより、それら複数のスチールボール112を第二の締結体104の係合

部114に係合せしめると共に、皿ばね106のばね力に基づく押圧力をもって、ピストン108の押圧面110にて複数のスチールボール112を押圧して、該係合部114を、複数のスチールボール112と第一の締結体102の第二の締結体104に対する前記接触部位との間でクランプするようになっており、以て、前記締結されるべき治具プレート11とベースエレメント13とを、軸方向に相対移動不能な状態で相互に締結し得るようになっているのである。また、このような締結装置による治具プレート11とベースエレメント13との締結状態を解除する際には、図6に示される如く、第一の締結体102の内部に形成される油圧室116内に所定の圧油118を導入せしめ、その際に生ずる油圧によりピストン108を皿ばね106のばね力に抗して軸方向他方側に移動せしめて、複数のスチールボール112を引込み移動させることにより、それら複数のスチールボール112の第二の締結体104の係合部114に対する係合を解消せしめるのである。

【0006】また、かかる締結装置と略同様な締結構造を有する装置として、特開平10-138068号公報に開示される締結装置も、知られている。この締結装置は、ニップルと称される第二の締結体を、クランピングシリンダと称される第一の締結体に設けられた中心孔内に挿入して、それら第一の締結体と第二の締結体とを軸方向において互いに接触するように組み合せた状態下で、複数のスチールボールに相当する複数のロッキングピストンを、ばね力により軸方向一方側に移動せしめられたピストンのテバ面形状の押圧面にて押圧し、前記中心孔内に突出せしめて、第二の締結体に係合せると共に、該ばね力に基づく押圧力をもって、第二の締結体を、複数のロッキングピストンと、第一の締結体の第二の締結体に対する接触部位との間でクランプすることにより、第一及び第二の締結体のそれぞれが取り付けられた二つの部材を、相互に締結するようにしたものである。なお、かかる締結装置にあっても、二つの部材の締結状態を解除する際には、ピストンを、油圧により、ばね力に抗して軸方向他方側に移動せしめて、複数のロッキングピストンを引込み移動させることにより、それら複数のロッキングピストンの第二の締結体に対する係合を解消せしめるのである。

【0007】このような従来の締結装置を用いれば、締結されるべき二つの部材に位置固定に取り付けられた第一の締結体102と第二の締結体104とを軸方向において互いに接触するように組み合せた状態下で、単に、第一の締結体102内部の油圧室116内に導入された圧油118を該油圧室116内から排出する操作や、かかる圧油118を油圧室116内に導入する操作を行うだけで、締結されるべき二つの部材の締結及びその解除を、極めて容易に且つ迅速に行なうことが出来るのである。

【0008】ところが、上述の如き従来の締結装置にあっては、何れも、複数のスチールボール112乃至はロッキングピストンの突出移動を確実に行わしめるために、ピストン108の移動ストロークが十分に大きく設定されており、また、油圧室116内に導入される圧油118の圧力を可及的に小さく抑えつつ、油圧室116内において、ピストン108に対して、より大きな圧力を及ぼし得るよう、ピストン108の圧力受容面の面積も比較的に大きく設定されているところから、油圧室116内に導入される圧油118の量が不可避的に多くなってしまうといった欠点があったのである。

【0009】それ故、そのような従来の締結装置を複数用いて、大面積を有する部材同士を締結する際等に、圧油を大量に吐出可能な大型の油圧ポンプが必要となり、それによって、それらの部材の締結作業の作業性が著しく悪化するばかりでなく、その作業コストも高騰するといった問題が惹起されていたのである。

【0010】

【解決課題】ここにおいて、本発明は、上述せる如き事情を背景にして為されたものであって、その解決課題とするところは、締結されるべき二つの部材のそれぞれに対して位置固定に取り付けられる二つの締結体を有し、それら二つの締結体のうちの一方のものを他方のものに係合させつつ、所定の付勢力に基づくクランプ力をもって、該他方の締結体を一方の締結体にてクランプすることにより、前記二つの部材を相互に締結する一方、該付勢力に抗して発揮される油圧により、該一方の締結体による該他方の締結体のクランプを解消せしめて、それら二つの部材の締結状態を解除するようにした締結装置において、かかる油圧を生ぜしめる圧油の量を有利に減少せしめ得るようにした新規な構造を提供することにある。

【0011】

【解決手段】そして、本発明にあっては、かかる課題を解決するために、締結されるべき二つの部材のうちの一方の部材に対して位置固定に取り付けられる第一の締結体と、該二つの部材のうちの他方の部材に対して位置固定に取り付けられ、該第一の締結体に対して嵌合せしめられる第二の締結体とを有すると共に、該第一の締結体に対して、第一及び第二の付勢手段のそれぞれの付勢力により軸方向一方側に移動せしめられ、且つ油圧により軸方向他方側に移動せしめられる第一及び第二のピストン部材と、該第一のピストン部材の軸方向一方側への移動により、該軸方向に対して直角な方向に移動して、該第一の締結体から突出せしめられる少なくとも一つの移動部材とが設けられる一方、前記第二の締結体に対して、該第一の締結体の移動部材に、その突出状態下において係合可能な係合部が設けられて構成され、それら第一の締結体と第二の締結体とを前記軸方向において嵌合するように組み合わせた状態下で、該第一のピストン部

材を前記第一の付勢手段の付勢力により軸方向一方側に移動せしめて、前記移動部材を該第一の締結体から突出せしめることにより、該移動部材を前記第二の締結体の係合部に係合せしめる一方、該第二のピストン部材を前記第二の付勢手段の付勢力により軸方向一方側に移動せしめることによって、該第二の締結体の係合部に係合せしめられた該移動部材を該第二のピストン部材にて押圧し、該第二の締結体を、該移動部材と該第一の締結体の該第二の締結体に対する前記嵌合部位との間でクランプして、前記締結されるべき二つの部材を少なくとも前記軸方向に相対移動不能な状態で相互に締結するようにしたことを特徴とする締結装置を、その要旨とするものである。

【0012】このような本発明に従う締結装置にあっては、第一の締結体に対して、第一及び第二の二つのピストン部材が設けられ、それら二つのピストン部材のうち、第一のピストン部材が、第一の付勢手段の付勢力にて軸方向一方側に移動せしめられることにより、移動部材が突出移動せしめられて、第二の締結体の係合部に係合せしめられる一方、第二のピストン部材が、第二の付勢手段の付勢力にて軸方向一方側へ移動にせしめられることにより、第二の締結体が、突出移動せしめられた移動部材と第一の締結体との間でクランプされるようになっているところから、移動部材を突出移動せしめるための第一のピストン部材と、かかる移動部材と第一の締結体との間で第二の締結体をクランプするための第二のピストン部材とを、互いに異なる移動ストロークや圧力受容面の面積をもって構成することができる。

【0013】それ故、かかる締結装置においては、移動部材を突出移動せしめるための第一のピストン部材の移動ストロークを、移動部材が確実に突出移動せしめられ得るように十分に大きく設定しつつ、その圧力受容面の面積を小さく為すことが出来、また、移動部材と第一の締結体との間で第二の締結体をクランプするための第二のピストン部材の圧力受容面の面積を、より大きな油圧が及ぼされ得るように比較的に大きく設定しつつ、その移動ストロークを小さく為すことが可能となっているのであり、それによって、従来の締結装置、つまり、第一の締結体にピストン部材が一つだけ配設されてなり、そして、このピストン部材にて移動部材が確実に突出移動せしめられ、且つかかる一つのピストン部材に対してより大きな油圧が及ぼされ得るように、該一つのピストン部材が大きな移動ストロークと大きな圧力受容面の面積とをもって構成された締結装置に比して、ピストン部材を付勢手段の付勢力に抗して軸方向他方側に移動させるのに必要な圧油の量を、有利に少なく抑えることが可能となるのである。

【0014】従って、かくの如き本発明に従う締結装置にあっては、締結された二つの部材の締結状態を解除するのに必要とされる圧油の量が、従来の締結装置に比し

て、極めて効果的に減少せしめられ得るのである。そして、その結果、締結装置を複数用いて、大面積を有する部材同士を締結する際等において、圧油を大量に吐出可能な大型の油圧ポンプを用いる必要が皆無ならしめられ得、以て、かかる部材同士を締結せしめる際における作業性が有利に高められ得ると共に、その作業コストが効果的に低く抑えられ得こととなるのである。

【0015】なお、このような本発明に従う締結装置の有利な態様の一つによれば、前記第一のピストン部材と前記移動部材との間に、該第一のピストン部材の軸方向の運動を該軸方向に対して直角な方向の運動に変換して該移動部材に伝達するカム機構が構成され、かかるカム機構により、該第一のピストン部材の前記軸方向一方側への移動に伴って、該移動部材が、該軸方向に対して直角な方向に移動せしめられて、前記第一の締結体から突出せしめられるように構成される。このような構成を有する締結装置においては、移動部材が、比較的簡略な構造をもって、軸方向に対して直角な方向に移動せしめられ得て、第一の締結体から、確実に突出せしめられ得ることとなる。

【0016】また、本発明に従う締結装置の好ましい別の態様の一つによれば、前記移動部材が、ボール部材にて構成され、それによって、第一の締結体からの移動部材の突出移動が、よりスムーズに行われ得るのである。

【0017】さらに、本発明に従う締結装置の他の好ましい態様の一つによれば、前記第二のピストン部材の軸部に、前記第一のピストン部材に対して及ぼされる前記油圧を圧油の導入により生ぜしめる第一の油圧室を与える、軸方向に延びる押通穴からなるシリンダ部が設けられて、かかる第二のピストン部材のシリンダ部内に、該第一のピストン部材が、該第一の油圧室内で生ぜしめられる油圧により前記軸方向他方側に移動せしめられ、且つ前記第一の付勢手段の付勢力により前記軸方向一方側に移動せしめられるように配置される一方、前記第一の締結体が、前記第二のピストン部材に対して及ぼされる前記油圧を圧油の導入により生ぜしめる第二の油圧室を与えるシリンダ部材を更に有して構成されて、かかるシリンダ部材内に、該第二のピストン部材が、該第二の油圧室内で生ぜしめられる油圧により前記軸方向他方側に移動せしめられ、且つ前記第二の付勢手段の付勢力により前記軸方向一方側に移動せしめられるように配置されることとなる。

【0018】このような構成を有する締結装置にあっては、第二のピストン部材が、所定のシリンダ部材内に配設された状態で、第一のピストン部材が、該第二のピストン部材の軸部に設けられたシリンダ部内において、同軸的に配設されることになるため、それら第一のピストン部材と第二のピストン部材とが、左右方向や上下方向に離間して配設される場合に比して、装置全体の大きさが小型化され、比較的コンパクトに構成され得るので

ある。

【0019】また、前記第一のピストン部材と前記第二のピストン部材が上述のようにして配置される場合には、有利には、該第二のピストン部材における前記シリンダ部の、前記シリンダ部材から外方に突出せしめられた部位の側壁に、前記軸方向に対して直角な方向において該側壁を貫通して延びる貫通孔が形成されると共に、かかる貫通孔内に、前記移動部材が、該貫通孔の延びる方向に移動可能に配置され、該シリンダ部内での前記第一のピストン部材の前記軸方向一方側への移動により、かかる移動部材が、該貫通孔内をそれが延びる方向に移動せしめられて、該貫通孔の開口部から突出せしめられることにより、前記第一の締結体から突出せしめられるように構成される。

【0020】かくの如き構成によれば、移動部材が、第二のピストン部材におけるシリンダ部において、その側壁に設けられた貫通孔内に配置されて、かかる貫通孔を通じて、第一のピストン部材の軸方向に対して直角な方向に突出／引込み移動せしめられるように構成されることとなるところから、移動部材の配設スペースを第一及び第二のピストン部材の配設スペースとは別に設ける必要がなく、それによって、装置全体の小型、コンパクト化が、より有効に図られ得るのである。

【0021】さらに、前記第一のピストン部材と前記第二のピストン部材の前述の如き配置状態下では、好ましくは、前記第一の油圧室に、前記圧油を外部から導入する導入口を設けると共に、該第一の油圧室と前記第二の油圧室との間に、それらを連通する連通孔を設けて、該導入口から該第一の油圧室内に導入される圧油が、該連通孔を通じて該第二の油圧室に向かって流動せしめられるように構成される一方、該連通孔を液密に閉塞し得る弁体を、該第二の油圧室側から該第一の油圧室側に向かって付勢せしめられた状態で配置して、該第一の油圧室内に前記圧油が充満するまでは、該弁体にて該連通孔を液密に閉塞し、且つ該圧油が充満せしめられた第一の油圧室内に該圧油が更に導入せしめられた際には、該弁体を、それに作用せしめられる付勢力に抗して該第一の油圧室側から該第二の油圧室側に向かって移動させて、該連通孔の該弁体による閉塞を解消し得るよう構成されることとなる。

【0022】このような構成によれば、圧油が、先ず、第一の油圧室内のみに導入され、該第一の油圧室内に圧油が充満した後、始めて、第二の油圧室内に、圧油が流入せしめられることになるため、第一及び第二の油圧室のそれぞれに対して、圧油が確実に充満せしめられ得ることとなるのである。

【0023】更にまた、前記第一のピストン部材と前記第二のピストン部材の前述の如き配置状態下では、好ましくは、前記第一の油圧室に、その内部に導入された前記圧油を外部に排出する排出口を設けると共に、前記第

一のピストン部材における前記軸方向一方側の先端に、前記連通孔内に挿通可能な突部を設けて、該第一の油圧室の圧油の全部を該排出口から外部に排出した状態下で、該第一のピストン部材を前記第一の付勢手段の付勢力により該軸方向一方側に移動せしめて、該第一のピストン部材の前記突部を前記連通孔内に挿通せしめることにより、該突部にて前記弁体を押圧し、それに作用せしめられる前記付勢力に抗して該第一の油圧室側から前記第二の油圧室側に向かって移動させて、該連通孔の該弁体による閉塞を解消せしめることにより、該第二の油圧室の前記圧油を該記連通孔を通じて該第一の油圧室内に流動せしめ、更に前記排出口を通じて該第一の油圧室内から外部に排出せしめるように構成される。

【0024】かかる構成を採用すれば、第一のピストン部材が、第一の付勢手段の付勢力にて軸方向一方側に移動せしめられて、移動部材が第一の締結体から突出移動せしめられると共に、第二の締結体の係合部に係合せしめられた後、始めて、第二のピストン部材が、第二の付勢手段の付勢力にて軸方向一方側に移動せしめられて、第二の締結体が、該移動部材と第一の締結体との間でクランプされることになるため、移動部材が、第一の締結体から十分に突出移動せしめられる前に、第二の締結体に対するクランプ力が、かかる移動部材と第一の締結体との間で生ぜしめられるようなことが有利に防止され得るのであり、以て、締結されるべき二つの部材を、極めて良好に且つ確実に締結することが出来るのである。

【0025】

【発明の実施の形態】以下、本発明を更に具体的に明らかにするために、本発明に係る締結装置の具体的な構成について、図面を参照しつつ、詳細に説明することとする。

【0026】先ず、図1には、本発明に従う構造を有し、マシニングセンタ等の工作機械のテーブルに取り付けられるベースエレメントと治具プレートとを相互に締結するために用いられる締結装置の一例が、概略的に示されている。かかる図1からも明らかなように、締結装置は、第一の締結体10と第二の締結体12とを有して構成されており、第一の締結体10が、上下に対向配置された治具プレート11とベースエレメント13のうち、下方に位置するベースエレメント13に対して位置固定に取り付けられ、また、第二の締結体12が、上方に位置する治具プレート11に対して位置固定に取り付けられるようになっている。

【0027】そして、この締結装置を構成する第一の締結体10は、ベースエレメント13に固定されるシリンダ部材14と、該シリンダ部材14内において、軸方向に上下移動可能に配置された、第二のピストン部材としての大ピストン16と、該大ピストン16の内部において、軸方向に上下移動可能に配置された、第一のピストン部材としての小ピストン18とを、更に含んで成って

いる。

【0028】より具体的には、シリンダ部材14は、上方に向かって開口する浅底の略底面有底円筒形状を呈するバレル部20と、厚肉の略円板形状を呈するヘッド部22とを有している。また、このシリンダ部材14のバレル部20には、図示しない油圧ポンプ等に接続される、圧油23が流通可能な流油孔24が、筒壁を厚さ方向に貫通して、設けられていると共に、該筒壁の外周面に、水平方向に所定高さ突出するフランジ突起26が、複数、一体形成されている。更に、ヘッド部22には、その中央部に、円形の中心孔28が、該中央部を貫通して設けられており、また、かかる中心孔28の開口縁部に、中心孔28と同一内径を有する円筒状突起30が、該開口縁部から所定高さをもって上方に延び出すようにして、一体的に立設されている。

【0029】そして、そのようなヘッド部22が、バレル部20に対して、その上部開口部を複蓋して、ボルト固定されていると共に、バレル部20が、複数のフランジ突起26に配設された取付ボルト27にて、ベースエレメント13の上面に固定されており、以てシリンダ部材14が、中心孔28において上方に開口する、中空の略円柱形状をもって構成されていると共に、ベースエレメント13の上面に対して、位置固定に取り付けられているのである。

【0030】一方、大ピストン16は、全体として、下部部位が大径化された、縦断面逆T字状の略段付円柱形状を呈しており、T字の頭部に相当する下部部位が摺動部32とされている一方、T字の脚部に相当する上部部位が軸部34とされている。また、この大ピストン16の摺動部32は、シリンダ部材14のバレル部20の内径よりも僅かに小さな外径と、シリンダ部材14におけるバレル部20の底面からヘッド部22の下面までの高さよりも僅かに低い高さとを有して成っており、更に、軸部34は、シリンダ部材14のヘッド部22における中心孔28開口径よりも僅かに小さな外径と、ヘッド部22の厚さ寸法よりも十分に大きな高さとを有して構成されている。

【0031】そして、そのような大ピストン16が、摺動部32において、シリンダ部材14のバレル部20内に収容され、且つ該シリンダ部材14のヘッド部22の中心孔28を通じて、軸部34の上部部位を上方に突出せしめた状態で、シリンダ部材14内に配置され、また、そのような配置状態下で、摺動部32の外周面において、バレル部20の内周面に摺動しつつ、軸方向において上下に移動せしめられ得るようになっているのである。

【0032】なお、ここでは、かかる大ピストン16の上方への移動が、シリンダ部材14のヘッド部22の下面に対する摺動部32の上面の当接によって規制されており、また、その下方への移動が、シリンダ部材14の

バレル部20の底面に対する摺動部32の下面の当接によって規制されている(図2参照)。そして、大ピストン16の上方への移動によって、摺動部32の下方に形成されるシリンダ部材14の内側空間が、前記流油孔24を通じてバレル部20内に供給される圧油23が導入せしめられる第二の油圧室としての大油圧室36とされている。かくして、本実施形態では、大ピストン16の移動ストロークが比較的小さくされており、また、後述する如く、大油圧室36内への圧油23の導入により、該大油圧室36内で生ぜしめられる油圧を受ける圧力受容面(大ピストン16の摺動部32の下面)の大きさが十分に大きくされているのである。

【0033】ところで、かくしてシリンダ部材14内に配置された大ピストン16の中心部には、軸部34と摺動部32とを軸方向に貫通して延びる押通孔38が形成されている。この押通孔38は、軸部側開口部40と摺動部側開口部42とを接続する接続部44が、両開口部40、42よりも所定寸法小径化された段付きの円形孔から成っている。そして、そのような押通孔38において、摺動部32を貫通する部位、つまり、摺動部側開口部42とそれに連続する接続部44の一部分とを含む押通孔38の下部部位には、円筒金具46が、配設されている。即ち、この円筒金具46は、全体として、押通孔38における接続部44の摺動部側開口部42との連続部位の内側形状よりも一周り小さな略円筒形状を呈し、下端外周面にフランジ部48が一体形成されて成っており、このフランジ部48を摺動部側開口部42内に配置せしめつつ、押通孔38の下部部位に嵌入された状態下で、フランジ部48に押通されたボルトにより、大ピストン16に固定されているのである。

【0034】また、そのような円筒金具46は、上部側開口部が、所定寸法細小化されてなる狭窄開口部50とされた内孔51を有している。そして、この内孔51内に、その内径よりも十分に小さく、且つ狭窄開口部50の開口径よりも大きな径を有するボール弁52が、上下方向に移動可能に収容されており、また、ボール弁52の下方には、圧縮コイルばね54が、上端部をボール弁52の下部外周面に係止せしめ、且つ下端部を、内孔51の下部側開口部に螺着された略円筒状の係止金具56の上端面に係止せしめつつ、予備圧縮せしめられた状態で、配置されている。これにより、押通孔38内において、ボール弁52に対して、圧縮コイルばね54の付勢力よりも大きな外力が加わらない限りは、円筒金具46の内孔51における狭窄開口部50が、ボール弁52にて、液密に閉塞せしめられる一方、ボール弁52に対して、圧縮コイルばね54の付勢力よりも大きな外力が加わる際には、ボール弁52が圧縮コイルばね54の付勢力に抗して下方に移動せしめられて、ボール弁52による狭窄開口部50の閉塞が解消され、以て狭窄開口部50が、前記押通孔38の接続部44内に向かっ

て開口せしめられるようになっているのである。

【0035】さらに、かくの如き円筒金具46が配設される押通孔38の下部部位を与える大ピストン16の摺動部32には、その軸方向中間部位に、該軸方向に対して直角な方向に連続して延びる細孔からなる、圧油23が流通可能な流油路58が形成されている。そして、この流油路58は、押通孔38の接続部44における前記円筒金具46の嵌入部位の内周面と摺動部32の外周面とに開口し、且つ該摺動部32の外周面側開口部において、前記シリンダ部材14のバレル部20における流油孔24に連通するように構成されている。これによって、流油孔24を通じて外部から導入された圧油23が、流油路58を流動し、更に、押通孔38の接続部44を与える摺動部32の内周面と前記円筒金具46の外周面との間の隙間を通して、押通孔38の内部空間内に流入せしめられるようになっている。そして、前述の如くして、前記円筒金具46の狭窄開口部50のボール弁52による閉塞が解消された場合に限って、押通孔42の内部空間内に導かれた圧油23が、該円筒金具46の内孔51を通って、前記大油圧室36内に導入されるようになっているのである。なお、ここでは、摺動部32の外周面における流油路58の開口部を上下に挟んだ位置に、細い周溝がそれぞれ1条ずつ形成されて、それら各周溝内に、Oリング60が、各々一つずつ、配設されており、以て、流油孔24と流油路58との連通部位や大油圧室36からの圧油23の漏出が防止され得るようになっている。

【0036】また、大ピストン16の摺動部32においては、上面の内周部に、比較的浅い深さと所定の幅とを有する円形溝62が、軸部34を取り囲むようにして形成されており、この円形溝62内には、高さの低いテーパ筒形状を呈し、且つ中心部に円形孔を有する、第一の付勢手段としての二つの皿ばね64、64が、一つのものが反転せしめられた状態で、各円形孔において軸部34にそれぞれ外押されて、収容されている。そして、それら二つの皿ばね64、64にあっては、円形溝62内で、それぞれの小径側の端部外面が互いに接触しつつ、上下方向に重ね合わされていると共に、上側に位置する皿ばね64の外周縁部がシリンダ部材14のヘッド部2の下面に係合せしめられ、且つ下側に位置する皿ばね64の外周縁部が、大ピストン16における前記円形溝62の底面に係合せしめられた状態で、軸方向に予備圧縮せしめられて、配置されており、以て、大ピストン16が、二つの皿ばね64、64の付勢力により下方に付勢せしめられた状態で、シリンダ部材14内に位置せしめられているのである。

【0037】かくして、シリンダ部材14内において上下移動可能に配置された大ピストン16にあっては、二つの皿ばね64、64の付勢力により下方に移動せしめられるようになっており、また、そのような下方への移

動状態下で、流油孔24を通じて外部から供給されて、挿通孔42の内部空間内に導かれた圧油23が、円筒金具46の内孔51を経て、大油圧室36内に導入された際に、かかる大油圧室36内で生ぜしめられる油圧によって、二つの皿ばね64、64の付勢力に抗して、上方に移動せしめられるようになっているのである。

【0038】一方、小ピストン18は、全体として、上側半分の部位が大径化された略段付円柱形状を呈しており、上側半分の大径部位が軸部74とされている一方、下側半分の小径部位が摺動部76とされている。そして、この小ピストン18にあっては、全体の長さが、大ピストン16に設けられた前記挿通孔38の軸部側開口部40よりも所定寸法だけ長く、且つ、該軸部側開口部40上部開口を閉塞する閉塞板66の下面から、該挿通孔38の下部部位に配設された前記円筒金具46の上面までの長さよりも十分に短くされていると共に、軸部74の外径が、該軸部側開口部40の内径よりも十分に小さくされ、また、摺動部76の外径が、該挿通孔38の前記接続部44の内径よりも僅かに小さくされている。そして、そのような小ピストン18が、摺動部76の先端部位を挿通孔38の接続部44内に突入せしめた状態で、該挿通孔38の軸部側開口部40内に挿通されており、以て、摺動部76の外周面において、接続部44の内周面に摺動しつつ、挿通孔38内を軸方向において上下に所定寸法移動せしめられ得る状態で、大ピストン16の内部に配置されているのである。

【0039】なお、ここでは、かかる小ピストン18の上方への移動が、前記閉塞板66の下面への軸部74の上面の当接によって規制されており(図1参照)、また、その下方への移動が、前記円筒金具46の上面に対する摺動部76の下面の当接によって規制されている(図2参照)。そして、小ピストン18の上方への移動によって、摺動部76の下面と円筒金具46の上面との間に形成される挿通孔38の接続部44内の空間が、前記流油孔24と流油路58とを通じて、挿通孔38の内部空間内に供給される圧油23が導入される第一の油圧室としての小油圧室78とされている。これによって、本実施形態では、小ピストン18の移動ストロークが十分に大きくされており、また、後述する如く、小油圧室78内への圧油23の導入により、該小油圧室78内で生ぜしめられる油圧を受ける圧力受容面(小ピストン18の摺動部76の下面)の大きさが、大ピストン16のそれに比して十分に大きくされているのである。なお、図1中、80は、小油圧室78に導入された圧油23の漏出を防止するOリングである。

【0040】そして、そのような小ピストン18の軸部74の中心部には、上方に開口して、軸方向に延びるばね収容穴84が設けられており、該ばね収容穴84内に、第二の付勢手段としての圧縮コイルばね86が、配置されている。この圧縮コイルばね86は、一端部が、

ばね収容穴84の底面に係止せしめられる一方、他端部が、小ピストン18が挿通配置される挿通孔38の軸部側開口部40における上部開口を閉塞する前記閉塞板66の下面に係止せしめられた状態で、軸方向に予備圧縮せしめられて配置されており、以て、小ピストン18が、圧縮コイルばね86の付勢力により下方に付勢せしめられている。

【0041】かくして、大ピストン16の挿通孔38内において上下方向に移動可能に配置された小ピストン18にあっては、圧縮コイルばね86の付勢力により下方に移動せしめられるようになっており、また、そのような下方への移動状態下で、流油孔24を通じて外部から供給された圧油23が、流油路58を経て、小油圧室78内に導入された際に、かかる小油圧室78内で生ぜしめられる油圧によって、圧縮コイルばね86の付勢力に抗して、上方に移動せしめられるようになっているのである。

【0042】そして、本実施形態では、特に、前記円筒金具46の内孔51内に配置された圧縮コイルばね54が、小油圧室78内に圧油23が充満するまでは圧縮せしめられないものの、圧油23が充満した小油圧室78内に、更に圧油23が導入せしめられた際には、該小油圧室78内で生ずる油圧によって圧縮せしめられるような大きさの付勢力を有して構成されている。また、小ピストン18における摺動部76の下面の中心部に、前記円筒金具46の狭窄開口部50内に突入可能な外径と、該狭窄開口部50の長さよりも所定寸法長い長さとを有する突起82が、一体的に設けられており、それによって、小ピストン18が、その下面を円筒金具46の上面に当接させる下方への移動端に位置せしめられた際に、円筒金具46の内孔51内のポール弁52が、突起82にて押圧されて、圧縮コイルばね54の付勢力に抗して下方に移動せしめられ、以て、該内孔51における狭窄開口部50のポール弁52による閉塞が解除されるようになっている。

【0043】従って、大ピストン16と小ピストン18とが、それぞれ下方への移動端に位置せしめられた状態下において、図示しない油圧ポンプ等に流油孔24が接続されて、圧油23が、流油孔24を通じて外部から供給された際には、先ず、かかる圧油23が、流油路58を流動し、挿通孔38における接続部44の内周面と円筒金具46の外周面との間の隙間を通して小油圧室78内に導入され、そして、そのような圧油23の導入に伴って小油圧室78内で生ずる油圧により、小ピストン18が、その軸部74内に配置された圧縮コイルばね86の付勢力に抗して、大きなストロークをもって上方に移動せしめられるようになっている。なお、このとき、円筒金具46の狭窄開口部50がポール弁52にて閉塞せしめられたままとされているため、圧油23が大油圧室36内に流入することはない(図4参照)。

【0044】引き続き、圧油23が小油圧室78内に導入されることにより、小油圧室78内に圧油23が充満せしめられて、小ピストン18が上方への移動端に達すると、該小油圧室78内における油圧により、円筒金具46の内孔51内のボール弁52が、圧縮コイルばね54の付勢力に抗して下方に移動せしめられて、該内孔51における狭窄開口部50のボール弁52による閉塞が解除される。これにより、圧油23が、該内孔51を通じて大油圧室36内に導入され、また、それに伴って大油圧室36内で生ずる油圧により、大ピストン16が、二つの皿ばね64、64の付勢力に抗して、僅かなストロークで上方に移動せしめられるようになっているのである。そして、大油圧室36内に圧油23が充満せしめられて、大ピストン16が上方への移動限度位置に到達せしめられた状態下で、前記油圧ポンプと流油孔24との間のバルブ(図示せず)が閉じられる等して、流油孔24が液密に閉塞されると、図1に示される如く、狭窄開口部50が、ボール弁52にて再び閉塞せしめられることとなる。

【0045】一方、かくして、大ピストン16と小ピストン18とが、それぞれ上方への移動端に位置せしめられた状態下において、油圧ポンプの停止下で前記バルブが開放されて、流油孔24の閉塞が解除された際には、先ず、小ピストン18が、圧縮コイルばね86の付勢力により下方に移動せしめられ、それに伴って、小油圧室78内の圧油23が、流油路58を通って、流油孔24から外部に排出される(図2参照)。そして、小油圧室78内の圧油23が全て排出されて、小ピストン18が下方への移動端に達すると、前述せる如く、小ピストン18の下面に設けられた突起82により、円筒金具46における狭窄開口部50のボール弁52による閉塞が解除されて、大ピストン16が、二つの皿ばね64、64の付勢力により下方に移動せしめられ、それに伴って、大油圧室36内の圧油23が、円筒金具46の内孔51を通じて小油圧室78内に向かって流動せしめられ、更に、流油路58と流油孔24を通じて外部に排出されるようになっている(図3参照)。そして、大油圧室36内の圧油23が全て排出されると、大ピストン18が、下方への移動端に到達せしめられるようになっているのである。これらのことから明らかなように、本実施形態では、第一の油圧室内に圧油を外部から導入する導入口と該第一の油圧室内の圧油を外部に排出する排出口とが、流油孔24にて構成されており、また、第一の油圧室と第二の油圧室とを連通する連通孔が、円筒金具46の内孔51にて構成されているのである。

【0046】また、ここにおいて、上述の如き移動構造をもって構成された大ピストン16と小ピストン18のうち、大ピストン16の軸部34には、シリンダ部材14からの突出部位における前記押通孔38の軸部側開口部40を与える筒壁の同一高さの複数箇所に、軸方向に

対して直角な方向において該筒壁を貫通して延びる貫通孔68が、それぞれ形成されている。そして、それら各貫通孔68内には、移動部材としてのスチールボール70が、それぞれ一つずつ、各貫通孔68の延出方向、換言すれば、軸方向に対して直角な方向に、摺動乃至は転がって移動せしめられる状態で、収容配置されている。また、それら各スチールボール70は、貫通孔68の延出方向の長さ寸法よりも所定寸法大きな径をもって構成されており、それによって、貫通孔68における軸部34の外周面側開口部から何等突出せしめられない状態では、一部分が、軸部側開口部40内に突出せしめられる一方(図1参照)、貫通孔68における軸部34の内周面側開口部から何等突出せしめられない状態では、一部分が、軸部34から側方に突出せしめられるようになっている(図2参照)。

【0047】なお、かかる大ピストン16の軸部34の外周面における各貫通孔68の開口縁部には、その開口径よりも僅かに小さな内径を有するゴムリング72がそれぞれ固着されており、それによって、例えば、第一の締結体10が傾けられたり、倒されたりした際等に、スチールボール70が、ゴムリング72の内側部位に接触せしめられて、貫通孔68から外部に、容易に離脱しないようになっている。また、大ピストン16の軸部34の外周面における下部部位に、細い周溝が1条形成されており、この周溝内にも、Oリング60が配設されている。

【0048】そして、小ピストン18の軸部74の上端部には、径方向に所定高さ突出し、且つ周方向に連続して延びる突出部88が形成されている。この突出部88にあっては、その外周面が、大ピストン16の押通孔38における軸部側開口部40の内径よりも僅かに小さな外径を有する保持面89とされていると共に、その下面が、上方に向かうに従って次第に大径となるテーパ面形状を呈する押圧面90とされており、また、小ピストン18が上方の移動端に位置せしめられた状態下において、該突出部88の押圧面90が、大ピストン16の軸部34に設けられた各貫通孔68と同一の高さに位置せしめられる一方(図1及び図4参照)、小ピストン18が下方の移動端に位置せしめられた状態では、該突出部88の保持面89が、それら各貫通孔68と同一の高さに位置せしめられるようになっている(図2及び図3参照)。

【0049】さらに、本実施形態では、図1に示される如く、小ピストン18が前記圧縮コイルばね86の付勢力に抗して上方への移動端に位置せしめられた状態下において、大ピストン16の軸部34の各貫通孔68内に配置された各スチールボール70が、その一部分を軸部側開口部40内に突出させて位置せしめられると共に、かかる突出部位において、小ピストン18の軸部74における押圧面90に対して接触せしめられるように構成

されている。

【0050】従って、小ピストン18が、上方への移動端位置から、圧縮コイルばね86の付勢力にて下方に移動せしめられることにより、各貫通孔68内に配置されたスチールボール70が、前述の如きテーパ面形状とされた押圧面90にて軸方向に直角な方向に押圧されて、各貫通孔68内を、該貫通孔68における大ピストン16の軸部34の外周面側開口部に向かって移動せしめられる。そして、小ピストン18が下方への移動端に達した際に、各スチールボール70の一部分が、貫通孔68における軸部34の外周面側開口部を通じて、軸部34から側方に突出せしめられると共に、突出部88の保持面89にて、そのような突出状態が保持されるようになっている(図2参照)。このことから明らかのように、本実施形態では、小ピストン18と各スチールボール70との間で、押圧面90をカム面とするカム機構が構成されているのである。

【0051】一方、第二の締結体12は、第一の締結体10における大ピストン16の軸部34が押通可能な大きさの内孔を有する、全体として、略円筒形状を呈している。また、かかる円筒状の第二の締結体12の内周面における軸方向中間部位には、径方向内方に向かって所定高さ突出し、且つ周方向に連続して延びる係合突部92が、一体的に形成されている。この係合突部92は、大ピストン16の軸部34の外径よりも僅かに大きな内径をもって成っており、その上面が、下方に向かうに従って次第に小径となるテーパ面形状を有する係合面94とされている一方、その下面が、水平面からなる接触面96とされている。そして、このような第二の締結体12にあっては、下部外周面に一体形成された外フランジ部98に配設された複数の取付ボルト100により、治具プレート11の下面に対して位置固定に取り付けられている。

【0052】而して、かくの如き構成を有する第二の締結体12と前述の如き構造とされた第一の締結体10とを有する本実施形態の締結装置が用いられる場合には、治具プレート11とベースエレメント13との締結とその解除とが、例えば以下のようにして行われることとなる。

【0053】すなわち、先ず、図1に示されるように、ベースエレメント13と治具プレート11とを、それらにそれぞれ固定された第一の締結体10と第二の締結体12とが互いに離し、且つ同軸的に位置するように、対向配置させる。そして、そのような配置状態下で、ベースエレメント13に固定された第一の締結体10の大油圧室36内と小油圧室78内とに、前述せる如くして圧油23を充満せしめることにより、大ピストン16と小ピストン18とを、それぞれ、二つの皿ばね64、64と圧縮コイルばね86の付勢力に抗して上方への移動端に位置せしめると共に、大ピストン16の各貫通孔6

8内のスチールボール70を、該大ピストン16に設けられた押通孔38の軸部側開口部40内に突出せしめ、且つその突出部位において、小ピストン18の軸部74における押圧面90に接触させて位置せしめる。なお、このとき、各スチールボール70が、第一の締結体10から、その側方に何等突出せしめられていないようにしておく必要がある。

【0054】次いで、図2に示される如く、第一の締結体10において、シリンダ部材14から突出せしめられた、大ピストン16の軸部34の突出部位に、第二の締結体12を外嵌させる。このときの第二の締結体12の第一の締結体10への外嵌位置は、第二の締結体12の係合突部92の接触面96が、第一の締結体10のシリンダ部材14における円筒状突起30の水平な上面に当接せしめられる位置とする。

【0055】その後、かかる第二の締結体12の第一の締結体10への外嵌状態下で、第一の締結体10における流油孔24の閉塞状態を解除することにより、小ピストン18を圧縮コイルばね86の付勢力により下方に移動せしめて、小油圧室78内の圧油23を、流油路58と流油孔24を通じて外部に排出する。また、それと共に、この小ピストン18の下方への移動に伴って、前述の如く、前記押通孔38の軸部側開口部40内に突出せしめられた各スチールボール70を、小ピストン16の突出部88の押圧面90により押圧して、各貫通孔68内を移動させ、それら各スチールボール70のそれぞれの一部部位を、貫通孔68における軸部34の外周面側開口部を通じて、大ピストン16の軸部34、つまり、第一の締結体10から側方に突出せしめる。そして、小ピストン18を更に下方へ移動させて、下方の移動端に到達せしめることにより、各スチールボール70の突出部位を、第二の締結体12における係合突部94の係合面96に係合せしめる。なお、このとき、各スチールボール70が、その突出側とは反対側部位において、小ピストン18の突出部88の保持面89に当接せしめられ、それによって、各スチールボール70の第一の締結体10からの突出状態が保持せしめられることとなる。

【0056】次いで、図3に示されるように、上述の如くして小ピストン18を下方への移動端に到達せしめることにより、狭窄開口部50のボルト弁52による閉塞を解除して、大ピストン16を二つの皿ばね64、64の付勢力により下方に移動せしめて、大油圧室36内の圧油23を、円筒金具46の内孔51を通じて小油圧室78内に向かって流動せしめ、更に、流油路58と流油孔24を通じて外部に排出する。そして、このような大ピストン16の下方への移動に伴って、大ピストン16の各貫通孔68の上側内周面にて、各スチールボール70を下方に押圧し、また、それにより、第二の締結体12における係合突部94の係合面96に係合された各ス

チールボール70の突出部位と、前記シリンドラ部材14の円筒状突起30の上面との間で、第二の締結体12の係合突部94を、各スチールボール70に対する下方への押圧力に基づくクランプ力にてクランプするのであり、以て、第一の締結体10が固定されたベースエレメント13と、第二の締結体12が固定された治具プレート11とを、軸方向において上下に移動不能な状態で、相互に締結するのである。なお、このとき、各スチールボール70は、係合突部94のテーパ面形状とされた係合面96に対する押圧力の反力を基づいて、前記押通孔38の軸部側開口部40内に向かって作用する作用力を受けるが、前記保持面89との当接によって、押通孔38内への移動が阻止されることとなる。

【0057】また、そのような治具プレート11とベースエレメント13との締結状態を解除するには、先ず、図4に示される如く、油圧ポンプ等から供給される圧油23を、流油孔24と流油路58を通じて小油圧室78内に導入し、該小油圧室78内で生ずる油圧により、小ピストン18を圧縮コイルばね86の付勢力に抗して上方に移動せしめる。それによって、小ピストン18の突出部88の保持面89と各スチールボール70との当接を解消せしめて、上述の如く、それら各スチールボール70に対して作用せしめられる前記作用力により、各スチールボール70を、各貫通孔68内において、押通孔38の軸部側開口部40内に向かって引込み移動させ、以て、第二の締結体12における係合突部94の係合面96に対する各スチールボール70の係合を解除すると共に、各スチールボール70とシリンドラ部材14の円筒状突起30の上面との間での該係合突部94のクランプも解消せしめる。

【0058】そして、その後、小ピストン18を上方への移動端に位置せしめて、各スチールボール70を、第一の締結体10から側方に何等突出しない位置まで引込み移動させた状態下で、第二の締結体12と第一の締結体10とを上下方向に相対移動せしめることによって、治具プレート11とベースエレメント13との締結を解消するのである。

【0059】このように、本実施形態においては、小油圧室78内と大油圧室36内とに圧油23を導入して、それら両油圧室78、36内で生じる油圧によって、小ピストン18と大ピストン16とを、圧縮コイルばね86と二つの皿ばね64、64の付勢力に抗して上方に移動せしめることにより、治具プレート11とベースエレメント13との締結状態が解除されるようになっているのであるが、前述せる如く、小ピストン18が、大きな移動ストロークと小さな面積の圧力受容面とを有して構成され、また大ピストン16が、小さな移動ストロークと大きな面積の圧力受容面とをもって成っているところから、治具プレート11とベースエレメント13との締結状態が解除せしめるために、小油圧室78内と大油圧室36内とに圧油23を導入する。

室36内に導入される圧油23の合計量が、移動ストロークと圧力受容面の面積とが何れも大きく設定された一つのピストンを有してなる従来の締結装置において、締結された二つの部材の締結状態を解除せしめるのに必要される圧油の量よりも、極めて効果的に少なく抑えることが出来るのである。

【0060】従って、このような本実施形態の締結装置にあっては、例えば、大面積の治具プレート11とベースエレメント13とを締結する場合等において、複数個が用いられても、圧油23を大量に吐出可能な大型の油圧ポンプ等を何等使用する必要がなく、それによって、それら大面積の治具プレート11とベースエレメント13とを締結せしめる際等における作業性を有利に高めることができ、また、その作業コストを有利に低減させることが可能となるのである。

【0061】また、かかる締結装置においては、小ピストン18の上端部に、突出部88の下面にて構成される、テーパ面形状を呈する押圧面90が設けられ、小ピストン18の下方への移動により、各スチールボール70が、この押圧面90にて押圧されて、第一の締結体10から側方に突出せしめられるようになっているところから、各スチールボール70の第一の締結体10からの突出移動が、極めて簡略な構造で、且つ確実に実現され得ているのである。

【0062】さらに、本実施形態の締結装置にあっては、小ピストン18が、大ピストン16の軸部34に形成された押通孔38内に、軸方向において上下に移動可能に、且つ同軸的に配置されていることから、小ピストン18が、第一の締結体10内に、場所を取らずに配設され得、それによって、第一の締結体10、ひいては締結装置全体が有利に小型、コンパクト化され得ているのである。

【0063】また、かかる締結装置においては、第一の締結体10から側方に向かって突出引込み移動せしめられる複数のスチールボール70が、小ピストン18の軸部74に形成される複数の貫通孔68内に配置されているところから、複数のスチールボール70の配置スペースを、小ピストン18と大ピストン16の配設スペースとは別に設ける必要がなく、それによって、第一の締結体10及び締結装置全体の小型、コンパクト化が、より有効に図られ得ることとなる。

【0064】さらに、かかる締結装置にあっては、小油圧室78と大油圧室36とを連通する円筒金具46の内孔51内に配置されたボール弁52による該内孔51の狭窄開口部50の開閉によって、小油圧室78に圧油23が充満せしめられた後に、始めて、大油圧室36内に圧油23が導入されるようになっているため、小油圧室78と大油圧室36のそれぞれに対して、圧油23が、より確実に充満せしめられ得るのである。

【0065】更にまた、本実施形態の締結装置において

は、小油圧室78内の圧油23が全て排出されて、小ピストン18が下方への移動端に位置せしめられた際に、該小ピストン18の下面に設けられた突起82にて、円筒金具46の内孔51内のポール弁52を下方に移動せしめることにより、大油圧室36が小油圧室78に連通せしめられて、大油圧室36内の圧油23が小油圧室78を通じて排出せしめられつつ、大ピストン16が下方に移動せしめられるようになっているところから、各スチールボール70が、第二の締結体12の係合突部92に係合せしめられた後に、始めて、該係合突部92が、各スチールボール70と第一の締結体10のシリンダ部材14との間で、所定のクランプ力をもってクランプされ得ることとなり、それによって、各スチールボール70が係合突部92に対して十分に係合する前に、係合突部92に対するクランプ力が各スチールボール70とシリンダ部材14との間で生ぜしめられることが、有利に防止され得るのである。そして、その結果として、第一の締結体10と第二の締結体12とによって、それらがそれぞれ固定される治具プレート11とベースエレメント13とを、極めて良好に且つ確実に締結することが可能となるのである。

【0066】以上、本発明の具体的な構成について詳述してきたが、これはあくまでも例示に過ぎないのであって、本発明は、上記の記載によって、何等の制約をも受けるものではない。

【0067】例えば、前記実施形態では、第一のピストン部材たる小ピストン18が、第二のピストン部材たる大ピストン16の軸部34に形成された挿通孔38内に配置されていたが、かかる第一のピストン部材は、軸方向に移動せしめられるようになっておれば、その配設構造は、何等これに限定されるものではない。また、第二のピストン部材の配設構造も、前記実施形態に示されるものに、特に限定されるものでないことは、言うまでもないところである。

【0068】さらに、前記実施形態では、移動部材がスチールボール70にて構成されていたが、かかる移動部材は、第一の付勢手段の付勢力による第一のピストン部材の軸方向への移動によって、該軸方向に対して直角な方向に移動して、第一の締結体から突出移動せしめられるように構成されておれば良く、従って、かかる移動部材を適当なコロ部材や板材、或いはブロック体等にて構成しても、何等差し支えないのである。また、そのような移動部材の配設個数も、必ずしも複数とされている必要はなく、第二の締結体を第一の締結体との間で確実にクランプし得るのであれば、一つだけ配設するようにしても良い。

【0069】また、第一及び第二のピストン部材のそれぞれに対して所定の付勢力を及ぼす第一及び第二の付勢手段も、特に限定されるものではなく、公知の付勢手段が、前記実施形態に示されるものに代えて、適宜に採用

され得るのである。

【0070】さらに、それら第一及び第二のピストン部材のそれぞれに対して油圧を及ぼす第一及び第二の油圧室も、その配設位置や配設構造、或いは形状や個数等が、第一及び第二のピストン部材の配設形態等に応じて、適宜に変更され得るものである。

【0071】更にまた、前記実施形態では、第二の締結体12が、第一の締結体10に対して外嵌せしめられて、上下方向に組み合わされるように構成されていた

が、第一の締結体に、所定の嵌合孔を設け、この嵌合孔内に第二の締結体を挿通して嵌合することにより、第一の締結体と第二の締結体とを組み合わせたり、或いはそれら第一の締結体と第二の締結体とを左右方向等、上下方向とは異なる方向において組み合わせるように構成することも、勿論可能である。なお、第一の締結体の嵌合孔内に第二の締結体を挿通して嵌合する嵌合構造を採用する場合には、移動部材が、嵌合孔内に向かって、第一の締結体の内方に移動せしめられるように構成されることとなる。

【0072】加えて、前記実施形態では、本発明を、マシニングセンタ等の工作機械のテーブルに取り付けられるベースエレメントと治具プレートとを相互に締結するために用いられる締結装置に対して適用したものの具体例を示したが、本発明が、ベースエレメントと治具プレート以外の互いに締結されるべき二つの様々な部材を相互に締結するために用いられる締結装置に対しても、有利に適用され得ることとは、勿論である。

【0073】その他、一々列挙はしないが、本発明は、当業者の知識に基づいて種々なる変更、修正、改良等を加えた態様において実施され得るものであり、また、そのような実施態様が、本発明の趣旨を逸脱しない限り、何れも、本発明の範囲内に含まれるものであることは、言うまでもないところである。

【0074】

【発明の効果】以上の説明からも明らかのように、本発明に従う締結装置を用いれば、締結された二つの部材の締結状態を解除するのに必要とされる圧油の量が、従来の締結装置を用いる場合に比して、極めて有利に低減せしめ得るのであり、その結果として、締結装置を複数用いて、大面積を有する部材同士を締結する際等において、圧油を大量に吐出可能な大型の油圧ポンプを用いる必要が皆無ならしめられ得、以て、かかる部材同士を締結せしめる際における作業性が有利に高められ得ると共に、その作業コストが効果的に低く抑えられ得ることとなるのである。

【図面の簡単な説明】

【図1】本発明に従う締結装置の一例を示す縦断面説明図である。

【図2】図1に示された締結装置の使用状態を示す説明図であって、第一の締結体に第二の締結体を外嵌せしめ

た状態下で、第一の締結体から突出せしめた複数のスチールボールを第二の締結体の係合突部に係合せしめた状態を示している。

【図3】図1に示された締結装置の別の使用状態を示す説明図であって、複数のスチールボールの第一の締結体からの突出部位と第一の締結体シリンダ部材との間で、第二の締結体の係合突部をクランプして、第一及び第二の締結体がそれぞれ固定されたベースエレメントと治具プレートとを相互に締結せしめた状態を示している。

【図4】図1に示された締結装置の更に別の使用状態を示す説明図であって、ベースエレメントと治具プレートとの締結状態から、複数のスチールボールの係合突部に対する係合を解除した状態を示している。

【図5】従来の締結装置の使用状態を示す説明図であって、第一及び第二の締結体がそれぞれ固定されたベースエレメントと治具プレートとを相互に締結せしめた状態を示している。

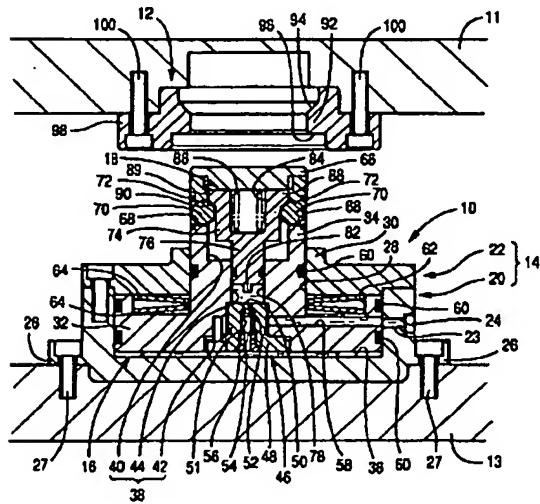
\* 【図6】図5に示された締結装置の他の使用状態を示す説明図であって、ベースエレメントと治具プレートとの締結状態を解除した状態を示している。

【符号の説明】

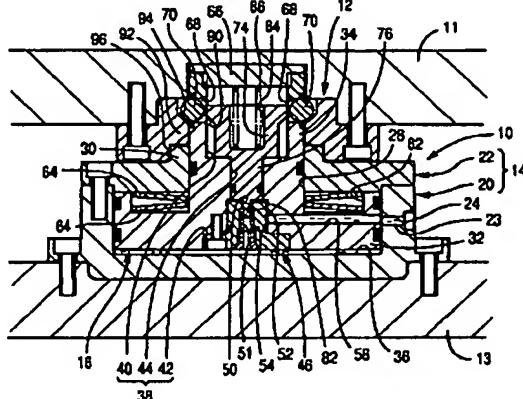
10	第一の締結体	11	治具プレート	
		12	第一の締結体	
			13	ベースエレメント
		14	シリンダ部材	
18	スチールボール	16	大ピストン	
38	大油圧室	36	小ピストン	
52	内孔	51	押通孔	
68	皿ばね	64	貫通孔	
78	スチールボール	70	大油圧室	
90	圧縮コイルばね	86	小油圧室	
92	係合突部	92	押圧面	

\*

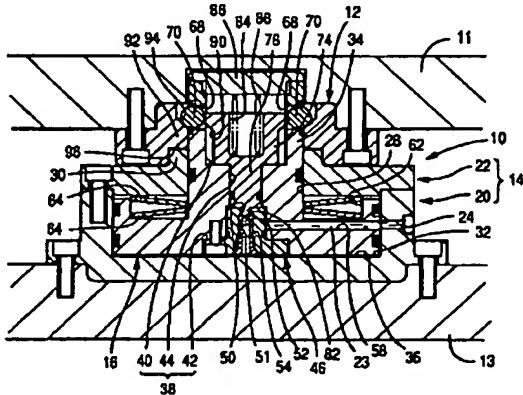
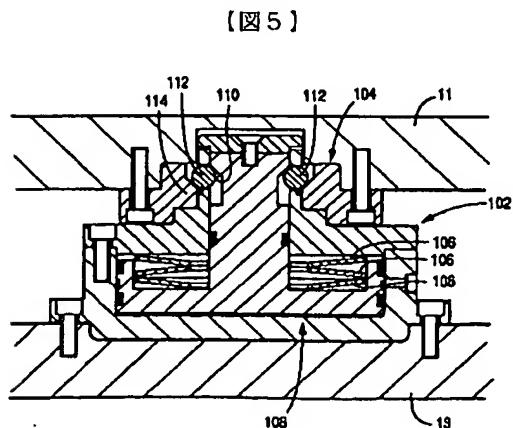
【図1】



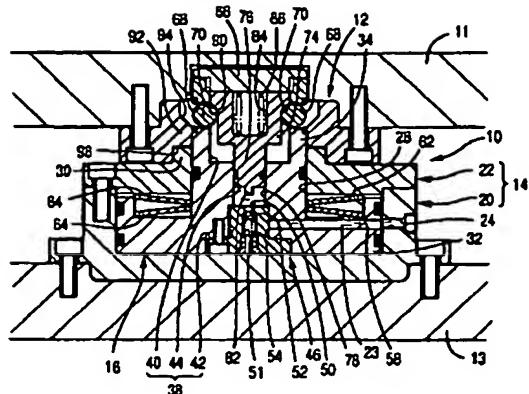
【図2】



【図3】



[図4]



(図6)

